N00204.AR.002565
NAS PENSACOLA
5090.3a

FEASIBILITY STUDY REPORT SITE 41 NAS PENSACOLA FL
8/1/2009
TETRA TECH NUS

**C**omprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62467-04-D-0555

Rev. 0
08/03/09

# Feasibility Study Report
## for
# Operable Unit 16, Site 41 - Combined Wetlands

## Naval Air Station Pensacola
## Pensacola, Florida

## Contract Task Order 0030

## August 2009

NAVFAC
Naval Facilities Engineering Command
NAS Jacksonville
Jacksonville, Fl 32212-0030

TETRA TECH NUS, Inc.

120820/P

# FEASIBILITY STUDY REPORT
# FOR
# OPERABLE UNIT 16, SITE 41 - COMBINED WETLANDS

**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**

**COMPREHENSIVE LONG-TERM**
**ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:**
**Naval Facilities Engineering Command**
**NAS Jacksonville**
**Jacksonville, Florida 32212-0030**


**Submitted by:**
**Tetra Tech NUS, Inc.**
**661 Andersen Drive**
**Foster Plaza 7**
**Pittsburgh, Pennsylvania 15220**



**CONTRACT NUMBER N62467-04-D-0055**
**CONTRACT TASK ORDER 0030**

**AUGUST 2009**



| PREPARED UNDER THE SUPERVISION OF: | APPROVED FOR SUBMITTAL BY: |
|---|---|
| GERALD WALKER, P.G.<br>TASK ORDER MANAGER<br>TETRA TECH NUS, INC.<br>TALLAHASSEE, FLORIDA | DEBRA M. HUMBERT<br>PROGRAM MANAGER<br>TETRA TECH NUS, INC.<br>PITTSBURGH, PENNSYLVANIA |

CERTIFICATION OF TECHNICAL
DATA CONFORMITY

The Contractor, Tetra Tech NUS, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-04-D-0555 are complete and accurate and comply with all requirements of this contract.

DATE: August 3, 2009

COMPANY CERTIFICATION AUTHORIZATION NUMBER: 7988
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, PA 15220

NAME AND TITLE OF CERTIFYING OFFICIAL: Gerald Walker, P.G.
Task Order Manager

This document, which describes the Feasibility Study for Operable Unit 16, Site 41 - Combined Wetlands, Naval Air Station Pensacola, located in Pensacola, Florida, has been prepared under the direction of a Florida-registered professional engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice.

____________________________________

William A. Wright
Professional Engineer No. PE 68917

Date: ______________________________

# TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

# TABLE OF CONTENTS (Continued)

**SECTION** **PAGE NO.**



**APPENDICES**



## TABLES

**NUMBER**

# FIGURES

**NUMBER**

# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AWQC | Ambient Water Quality Criterion |
| BEHP | bis(2-Ethylhexyl) phthalate |
| BERA | Baseline Ecological Risk Assessment |
| bgs | below ground surface |
| BSAF | Biota Sediment Accumulation Factor |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CKD | Cement kiln dust |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| COC | Chemical of concern |
| COPC | Contaminant of potential concern |
| CSF | Cancer Slope Factor |
| CTO | Contract Task Order |
| CTL | Cleanup Target Levels |
| CWA | Clean Water Act |
| DDD | Dichlorodiphenyldichloroethane |
| DDT | Dichlorodiphenyltrichloroethane |
| DGPS | Digital global positioning system |
| E/A&H | EnSafe/Allen and Hoshall |
| ECB | Environmental Compliance Branch |
| E&E | Ecology & Environment, Inc. |
| EEC | Extreme Effects Concentration |
| EqP | Equilibrium Partitioninq Quotient |
| ERM | Effects Range Mean |
| F.A.C. | Florida Administrative Code |
| FCM | Food-Chain Model |
| FDEP | Florida Department of Environmental Protection |
| FS | Feasibility Study |
| $ft^2$ | square foot |
| GAC | Granular activated carbon |
| GRA | General Response Action |
| HQ | Hazard Quotient |
| HHRA | Human Health Risk Assessment |
| IWTP | Industrial waste water treatment plant |

| | |
|---|---|
| LDR | Land disposal restriction |
| LOAEL | Lowest observed adverse effects level |
| LUC | Land Use Control |
| LUCIP | Land Use Control Implementation Plan |
| mg/L | milligram per liter |
| NACIP | Navy Assessment and Control of Installation Pollutants |
| NADEP | Naval Aviation Depot |
| NAS | Naval Air Station |
| NATTC | Naval Air Technical Training Center |
| NAVFAC SE | Naval Facilities Engineering Command Southeast |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NEPA | National Environmental Policy Act |
| NEESA | Naval Energy and Environmental Support Activity |
| NOAEL | No observed adverse effects level |
| NOEC | No Observable Effects Concentration |
| NPDES | National Pollutant Discharge Elimination System |
| O&M | Operation and maintenance |
| OSHA | Occupational Safety and Health Act |
| OU | Operable Unit |
| PAH | Polynuclear aromatic hydrocarbon |
| PCB | Polychlorinated biphenyl |
| PPE | Personal protection equipment |
| PRG | Preliminary Remediation Goal |
| RAO | Remedial Action Objective |
| RBC | Risk-Based Criterion |
| RCM | Reactive core mat |
| RCRA | Resource Conservation and Recovery Act |
| RD | Remedial Design |
| RfD | Reference Dose |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SQG | Sediment Quality Guideline |
| SWCTL | Surface Water Cleanup Target Level |
| SWMU | Solid Waste Management Unit |
| SWPPP | Storm Water Pollution Prevention Program |
| TBC | To Be Considered |
| TCLP | Toxicity Characteristic Leaching Procedure |

| | |
|---|---|
| TEC | Threshold Effects Concentration |
| TOC | Total organic carbon |
| TRPH | Total recoverable petroleum hydrocarbons |
| TSDF | Treatment, storage, and disposal facility |
| TtNUS | Tetra Tech NUS, Inc. |
| U.S.C. | United States Code |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| VOC | Volatile organic compound |

# EXECUTIVE SUMMARY

## E.1 PURPOSE OF THE REPORT

The purpose of this Feasibility Study (FS) Report is to develop and evaluate options for the remediation of contaminated sediment at Operable Unit 16 Site 41 – Combined Wetlands, Naval Air Station (NAS), Pensacola, Florida.

## E.2 SITE DESCRIPTION AND HISTORY

The United States Navy (Navy) has maintained a presence in the Pensacola area since 1825, when a Navy yard was established on Pensacola Bay. Between 1828 and 1835, the Navy acquired approximately 2,300 acres as operations expanded. Several natural disasters in the early 1900's destroyed the yard and forced it into maintenance status in 1911. Three years later, the Navy's first permanent air station was established on the site of the old Navy yard. The air station has been the primary training base for naval aviators since that time and the base continues to expand.

For the purpose of organization within this FS, the wetlands within Operable Unit (OU) 16 have been grouped based on geographic location. Wetlands 3, 15, 16, 18A, and 18B are all located within the vicinity of NAS Pensacola's OU 1 (Site 1) landfill. Wetland 5A and Wetland 64 are associated with NAS Pensacola's OU 2. Wetland 5A is located to the east of the A.C. Read Golf Course and Wetland 64 is an approximately 41-acre area on the eastern shore of the upstream side of the NAS Pensacola Yacht Basin, which is in the northeastern quadrant of the base. The remaining wetland being evaluated is Wetland 48. Wetland 48 is in a mostly undeveloped portion of NAS Pensacola, north of Radford Boulevard, and south of the NAS Pensacola Fuel Farm.

### E.2.1 <u>Operable Unit 1 (Site 1) Landfill and Associated Wetlands</u>

During the early 1950s and continuing until 1976, a variety of domestic and industrial wastes generated from NAS Pensacola and other outlying Navy facilities were disposed at the Site 1 landfill. During the earlier years of disposal at Site 1, wastes commonly were burned before burial; however, this practice ended in the late 1960s due to residents' concern over air pollution in nearby areas. The landfill officially closed October 1, 1976.

**Wetland 3** - A shallow sheet flow of water drains from the southwest to the northeast across Wetland 3. The water then flows through a culvert, which runs under John T. Tower Road and beneath a golf course fairway. The culvert drains into Wetland 4D, which empties into Bayou Grande. The open water portion of the wetland ranges from 0 to about 3 feet in depth and from 3 to 500 feet in width.

**Wetland 15 -** Wetland 15 receives storm water runoff from the adjacent A.C. Read Golf Course and a small area of NAS Pensacola's Site 1. Wetland 15 is also affected by tidal influences in Bayou Grande. Drainage through the wetland complex is through a 3-foot wide channel that discharges to the Bayou Grande.

**Wetland 16 -** Wetland 16 generally flows northwest into Bayou Grande through a drainage channel about 3 feet wide. The open water portion of the wetland ranges from 1 foot to about 4 feet in depth and has a maximum width of about 200 feet. Wetland 16 is fed from the south and southeast by groundwater from Site 1 and from the northwest by tidal influences from Bayou Grande. Debris deposits to the south, from Site 1 and other abrupt transitions, make the border between open water and upland obvious.

**Wetlands 18A and 18B -** Wetland 18 is adjacent to the eastern shore of Redoubt Bayou, along the northern shoreline of Bayou Grande, situated at the midpoint of NAS Pensacola. Wetland 18A is located to the west of A.C. Read Golf Course and is affected by Site 1. The wetland has been divided into two parts, A and B. Wetland 18A, which flows into Wetland 18B, is fed by groundwater seeps from Site 1 to the east and is a long narrow finger-shaped wetland running east to west. Wetland 18A is shallower than one foot, and has a maximum width of 2 feet. Wetland 18B is at the mouth of Wetland 18 and Redoubt Bayou, and ranges from 1 foot to 8 feet deep, with a maximum width of 50 feet.

### E.2.2 Operable Unit 2 and Associated Wetlands

OU 2 is located in the northeastern portion of the base and is roughly 300 acres in size. OU 2 includes Sites 11 (North Chevalier Disposal Area), 12 (Scrap Bins), 25 (Radium Spill Area), 26 (Supply Department Outside Storage Area), 27 (Radium Dial Shop), and 30 (Building 649 Complex). The OU 2 investigation also included a portion of the former industrial waste water treatment plant (IWTP) sewer line serving the OU 2 area. The Site 41 wetlands associated with OU 2 include Wetlands 5A, 5B, 6, and 64. Wetlands 5B and 6 have not been retained for evaluation of remedial alternatives in this FS.

**Wetland 5A** - Wetland 5, a wooded area within the developed portion of NAS Pensacola, is bordered to the west by the A.C. Read Golf Course, to the north by the former Naval Aviation Depot (NADEP) Dynamic Components Division (Building 649 Complex) and other buildings formerly used by NADEP, and to the south by Taylor Road. Wetland 5A has been described as a palustrine forested system. Wetland 5A (roughly 1.3 acres in size) is connected to Wetland 5B (1.2 acres) by a culvert, which runs under Murray Road. A 200-300 foot vegetative buffer surrounding this area likely offers habitat to various species.

Wetland 5A is several decades old and likely began as a borrow pit. It served as a drainage pathway as early as the 1930s and reportedly contained a saw mill during the 1940s. A 1939 map of the base labeled Wetland 5 as an “open ditch.” In recent years, beaver dams constructed at the downstream end of Wetland 5A raised the water level in the basin containing this wetland, facilitating sedimentation and the emergence of a marsh. Since the repair of a faulty valve in a nearby potable water storage tank in 1994, the water level in Wetland 5A has receded. Wetland 5A continues to serve as a storm water conduit. NAS Pensacola Storm Drainage Map 1276912 shows three outfalls in Wetland 5A. Outfall T discharges storm water from the Bachelor Officers’ Quarters area to the south. Outfall V and an unnamed outfall discharge storm water from the former Building 649 Complex. Wetland 5A drains via Wetland 5B into Wetland 6, which empties into the NAS Pensacola Yacht Basin (Wetland 64). Typical vegetation found in Wetland 5A consists of hardwoods, such as oaks and sweet bay magnolias.

Wetland 5A is in a developed area of NAS Pensacola and may be affected by Sites 30 and 36, which are located near Wetland 5.

**Wetland 64 -** Wetland 64 is an approximately 41-acre area on the eastern shore of the upstream side of the NAS Pensacola Yacht Basin, which is in the northeastern quadrant of the base. The open water portion of the Wetland 64 complex is approximately 20 acres in size, ranging from about 2 to 15 feet in depth, and is 600 to 900 feet wide.

The western shore of the Yacht Basin contains the NAS Pensacola Yacht Club and marina. A concrete seawall exists along the shoreline of the marina, from which several docks housing numerous boats extend into the Yacht Basin. The western shore of the Yacht Basin also contains buildings, a paved parking area, a fenced area for boat storage, and road access. The eastern bank of the Yacht Basin remains relatively undisturbed.

Evaluation of maps and aerial photography from 1939 and 1951 reveal the Wetland 64 area was once approximately one-third larger than the current area. Sometime after 1939, approximately 15 acres in the southwest portion (the area now encompassing Site 11, North Chevalier Disposal Site) and approximately 10 acres along the west side (the area now containing the building and parking areas associated with the Yacht Basin) were filled apparently coincident with the construction of the marina.

### E.2.3 Remaining Wetlands

The wetlands grouped as “Remaining Wetlands” are Wetlands 19 (A and B), 56, 57, 58, W2, 48, and 49. These wetlands are across the western portion of NAS Pensacola near Forrest Sherman Field. Associated IR sites include:

- Site 1 (OU 1) — Sanitary Landfill
- Site 4 — Army Rubble Disposal Area
- Site 5 — Borrow Pit
- Site 6 — Fort Redoubt Rubble Disposal Area
- Site 16 — Brush Disposal Area
- Site 39 (OU 12) — Oak Grove Campground

Associated petroleum sites include Site 19 (Fuel Farm Pipeline Leak), Site 37 (Sherman Field Fuel Farm Area) and UST 18 (Crash Crew Training Area).

**Wetland 48 -** Wetland 48 is in a mostly undeveloped portion of NAS Pensacola, north of Radford Boulevard, and south of the NAS Pensacola Fuel Farm. It is a thickly vegetated palustrine forested wetland. Wetland 48 is located near Site 37, the Sherman Field Fuel Farm Area, which is located south of the western end of Forrest Sherman Field. The site consists of an approximately 3.5-acre, fenced area around the former fuel farm including four cut-and-cover storage tanks. The petroleum storage tank system was installed in 1945 and used to store JP-4 Jet Fuel. The fuel storage tanks were abandoned in place in 1995 after a new fuel facility was constructed adjacent to the south side of the original fuel farm. An equipment malfunction in 1983 resulted in the release of approximately 48,000 gallons of JP-4 Jet Fuel. Initial recovery efforts by NAS Pensacola personnel included the installation of four recovery ditches along the fence line in the northwestern corner resulting in the recovery of approximately 600 to 700 gallons of free product.

## E.3 SUMMARY OF ENVIRONMENTAL INVESTIGATIONS AND RESTORATION ACTIVITIES

Environmental investigations have been conducted at the various Site 41 Wetlands from 1974 through 1997 to characterize contaminants in sediment. Details of the investigations are provided in the Final Site 41 Remedial Investigation (RI) Report and the RI Report Addendum. The following sections provide a brief summary of the results of these investigations.

## E.4 SUMMARY OF INVESTIGATION FINDINGS

### Remedial Investigation

An RI was completed at the NAS Pensacola Site 41 wetlands in three phases: (1) Phase I was performed during August 1994; (2) Phase II (formerly called IIA) was performed from November 1995 through January 1996; (3) Phase III (formerly called IIB/III) was performed during August and September 1997. The RI conducted by EnSafe, Inc. (EnSafe) included an evaluation of the nature and extent of contamination in sediment, an analysis of contaminant fate and transport, and a human health and ecological risk assessment. The results of the RI were reported by EnSafe in 2007. The RI identified several contaminants of potential concern (COPCs) for each wetland. The COPCs were evaluated in this FS, and the chemicals of concern (COCs) retained are described below.

**Wetland 3**

The following COCs in sediment were retained for in Wetland 3:

| | |
|---|---|
| Human health COCs: | Arsenic |
| Ecological COCs: | Cadmium, iron, and endosulfan sulfate |

**Wetland 5A**

No human health COCs were retained for sediment at Wetland 5A. Ecological COCs in sediment are as follows:

| | |
|---|---|
| Ecological COCs: | Copper, lead, and zinc |

Endosulfan I was retained as an ecological COC in the RI but was eliminated based on comparison to the No Observable Effects Concentrations (NOEC), value determined through available toxicity data.

**Wetland 15**

The following COCs in sediment were retained at Wetland 15:

| | |
|---|---|
| Human health: | Arsenic, 4,4'-Dichlorodiphenyldichloroethane (DDD), 4,4'-DDE, Aroclor-1260, and delta-BHC |
| Ecological: | Aluminum, arsenic, barium, beryllium, iron, manganese, selenium, vanadium, endosulfan I, heptachlor, 2,2'-oxybis(1-Chloropropane)/ bis(2-chlor, 2,4-dimethylphenol, 2-methylphenol (o-cresol), 4-methylphenol, and phenol |

**Wetland 16**

The following COCs in sediment were retained for Wetland 16:

| | |
|---|---|
| Human health: | Aroclor-1254 |
| Ecological: | Aluminum, beryllium, iron, manganese, and vanadium. |

**Wetland 18A**

The following COCs in sediment were retained for Wetland 18A:

| | |
|---|---|
| Human health: | Arsenic and benzene. |
| Ecological: | Barium, iron, manganese, selenium, aldrin, 1,4-dichlorobenzene, and 4-methylphenol (p-cresol). |

**Wetland 18B**

The following COCs in sediment were retained for Wetland 18B:

| | |
|---|---|
| Human health: | Arsenic |
| Ecological: | Iron, manganese, and selenium. |

**Wetland 48**

The following COCs in sediment were retained for Wetland 48 sediment:

| | |
|---|---|
| Ecological: | 4,4'-DDD, 4,4'-DDE, 4,4'-Dichlorodiphenyltrichloroethane (DDT), and total DDT. |

**Wetland 64**

The following COCs in sediment were retained for Wetland 64 sediment:

| | |
|---|---|
| Human health: | 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-BCH, alpha-chlordane, Aroclor-1254, Aroclor-1260, delta-BHC, and gamma-chlordane, and BEHP. |
| Ecological: | BEHP, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, vanadium, zinc, endosulfan I, carbozale, and dibenzofuran. |

## E.5 REMEDIAL ACTION OBJECTIVES AND CLEANUP GOALS

Site-specific Remedial Action Objectives (RAOs) specify COCs, media of interest, exposure pathways, and cleanup goals or acceptable contaminant concentrations. This FS addresses sediment contamination at Site 41. The RAOs were developed to permit consideration of institutional controls, monitoring, and containment alternatives based on current and potential future land use. To protect the public from current and potential future health risks, as well as to protect the environment, the following RAOs were developed for Site 41:

- Prevent unacceptable human health risk associated with COCs at concentrations greater than established Preliminary Remediation Goals (PRGs) in sediment at Wetlands 3, 15, 16, 18A, 18B, 48, and 64.

- Reduce, to the extent practicable, unacceptable risk to aquatic receptors exposed to COCs at concentrations greater than established PRGs in sediment at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64.

PRGs are typically target concentrations to which COCs must be reduced within a particular medium of concern to achieve one or more of the established RAOs. PRGs are developed to ensure that contaminant concentrations left on site are protective of human and ecological receptors. PRGs were selected based on the results of the Human Health Risk Assessment (HHRA), Baseline Ecological Risk Assessment (BERA), toxicity testing No Observable Effects Concentrations (NOECs), and Applicable or Relevant and Appropriate Requirements (ARARs).

## E.6 SCREENING OF GENERAL RESPONSE ACTIONS, REMEDIATION TECHNOLOGIES, AND PROCESS OPTIONS

The following identifies and screens remediation technologies and process options for sediment at a preliminary stage based on implementation with respect to site conditions and COCs. The table below presents the General Response Actions (GRAs), identifies the technologies and process options, and provides a brief description of each process option followed by screening comments.

The following are the sediment remediation technologies and process options retained for detailed screening based on the results of preliminary screening:

| General Response Action | Remediation Technology | Process Option |
|---|---|---|
| No Action | None | Not Applicable |
| Limited Action | Land Use Controls (LUCs) | Institutional Controls |
| | | Engineered Controls |
| | Monitoring | Sampling and Analysis |
| | Natural Recovery | Biodegradation, Dilution, Dispersion |
| Containment | Physical Capping | Sediment Cover |
| | Reactive Media Cover | Reactive Core Mat |
| Removal | Bulk Excavation | Dredging |

| General Response Action | Remediation Technology | Process Option |
|---|---|---|
| In-Situ Treatment | Enhanced Natural Recovery | Thin-Layer Placement |
| | Biological | Phytoremediation |
| | Chemical/Physical | Stabilization/Solidification |
| Disposal | Landfill | Offsite Landfilling |

## E.7 DEVELOPMENT OF REMEDIAL ALTERNATIVES

The following alternatives for sediment remediation have been developed for all Site 41 wetlands:

- **Alternative SED-1: No Action**. No action would be taken. This alternative is retained as a baseline for comparison with other alternatives.

- **Alternative SED-2: Land Use Restrictions / Institutional Controls.** LUCs would consist of restrictions of land use. These controls would eliminate or reduce the potential for unacceptable human health risks as a result of exposure to contaminated sediment by restricting access to the wetlands. Restriction of land use would consist of preparing and implementing a Land Use Control Implementation Plan (LUCIP), including restrictions to prevent future access or development at the wetlands.

- **Alternative SED-3: LUCs and Natural Recovery.** The LUCs component would be the same as Alternative SED-2. During LUC implementation, natural processes such as leaching, biodegradation and sedimentation (cover) will improve the quality of the sediment. Annual sediment sampling would be conducted at each wetland to evaluate Natural Recovery.

The following alternatives for sediment remediation have been developed for Site 41 Wetlands 5A, 15, 16, 18A, 18B, 48, and 64:

- **Alternative SED-4a: Excavation and Off-Site Disposal (Wetlands 5A, 15, 16, 18A, 18B, 48 and 64).** Sediment contaminated with concentrations of COCs above human health and ecological PRGs would be excavated to 1 foot below ground surface (bgs). Although the general COC concentrations are considered ecological risks, all of the excavated sediment and cleared vegetation would be considered non-hazardous and could be disposed of in a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill. Wetland reconstruction would be necessary and would include the placement clean sand fill in the excavated areas. Plants matching the native species would be placed in the filled areas to return each wetland to pre-construction conditions.

- **Alternative SED-4b: Dredging and Off-Site Disposal (Wetland 64).** Sediment contaminated with concentrations of COCs above human health and ecological PRGs would be excavated via dredging. The dredged sediments removed from Wetland 64 would be hydraulically pumped to a processing or dewatering pad where the sediment would be pumped into geosynthetic filter bags (sediment bags) and allowed to dewater by gravity. Following the dewatering process, the removed sediment would be loaded into trucks and transported to an off-site landfill. Water removed from the sediment would be treated and discharged back to Wetland. Based on the contaminants in the sediment requiring removal, it is expected that the water treatment would include pumping the water through a filtration unit and an activated carbon unit. Although the general COC concentrations are considered ecological risks, all of the excavated sediment would be considered non-hazardous and could be disposed of in a RCRA Subtitle D landfill.

## E.8 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The remedial alternatives were analyzed in detail using seven of the nine criteria provided in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These seven criteria are as follows:

- Overall Protection of Human Health and the Environment.
- Compliance with ARARs and To Be Considered (TBC) guidance criteria.
- Long-Term Effectiveness and Permanence.
- Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment.
- Short-Term Effectiveness.
- Implementability.
- Cost.

Two other criteria, State and Community Acceptance, were not evaluated in this report. They will be evaluated after regulatory and public comments are available.

## E.9 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The remedial alternatives were compared to each other using the same criteria used for the detailed analysis. The following is a summary of the comparisons.

### Overall Protection of Human Health and Environment

Alternative SED-1 would not provide protection of human health and the environment.

Alternatives SED-2 and SED-3 would be protective of human health, but would not be immediately protective of ecological receptors. Alternative SED-3 would be slightly more protective than Alternative SED-2 because of the additional component of annual monitoring. Alternatives SED-4a and SED-4b would be more protective of human health and the environment than Alternatives SED-2 and SED-3.

**Compliance with ARARs and TBCs**

Alternative SED-1 would not comply with chemical-specific ARARs or TBCs because no action would be taken to reduce contaminant concentrations.

Alternatives SED-2 and SED-3 would comply with location-, and action-specific ARARs and TBCs. Chemical-Specific ARARs may eventually be achieved through LUCs. Monitoring would not be performed to evaluate natural recovery in Alternative SED-2. However, monitored natural recovery processes would be evaluated as part of Alternative SED-3.

Alternatives SED-4a and SED-4b would comply with all chemical-, location-, and action-specific ARARs and TBCs.

**Long-Term Effectiveness and Permanence**

Alternative SED-1 would have no long-term effectiveness and permanence because contaminated sediment would remain on site.

Alternatives SED-2 and SED-3 would provide long-term effectiveness and permanence for human health receptors. Restricting access would prevent unacceptable risk from direct exposure of trespassers (including recreational fishermen) and workers. Alternative SED-3 would also include monitoring natural recovery processes that would allow for evaluation of ecological risks over time.

Alternatives SED-4a and SED-4b would provide long-term effectiveness and permanence. Excavation of sediment contaminated above PRGs would effectively and permanently prevent unacceptable risk from exposure to contaminants and migration to surface water.

**Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment**

Alternatives SED-1, SED-2, SED-3, SED-4a, and SED-4b would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs might occur through sedimentation, leaching, biodegradation, and other natural attenuating factors, but Alternatives SED-1, SED-2, SED-4a, and SED-4b have no monitoring component to verify this. Alternatives SED-4a and SED-4b, however, would result in the relocation of contaminated sediment from the wetlands to a landfill.

**Short-Term Effectiveness**

Because no action would occur, implementation of Alternative SED-1 would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment. Alternative SED-1 would never achieve the RAOs and, although the cleanup goals might eventually be achieved through natural recovery, this would not be verified through monitoring.

No short-term risks would be incurred by workers from exposure to contaminated sediment during LUC implementation in Alternative SED-2.

Some short-term risks could be incurred by workers from exposure to contaminated sediment during on site sampling activities in Alternative SED-3 and during on site remedial activities in Alternatives SED-4a and SED-4b. However, the potential for exposure would be minimized by the wearing of appropriate personal protective equipment (PPE), and compliance with Occupational Safety and Health Act (OSHA) regulations and site-specific health and safety procedures. Any potential negative short-term impacts, during Alternatives SED-4a and SED-4b, to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.).

**Implementability**

Alternative SED-1 would be easiest to implement because there would be no activities to implement.

Alternatives SED-2 and SED-3 would be easily implementable. The administration aspects of Alternatives SED-2 and SED-3 would be relatively simple to implement. If a change in ownership was made, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions for Alternatives SED-2 and SED-3 and monitoring for Alternative SED-3.

Alternatives SED-4a and SED-4b would be the most complicated to implement compared to the other alternatives. The excavation component of Alternative SED-4a and dredging component of Alternative SED-4b could be performed with specialized construction equipment, resources, and materials that would be available for this purpose. Because the excavation component of Alternative SED-4a would be in wetland areas, dewatering and/or water flow diversion would be needed in some instances. The excavation component of Alternative SED-4b would be slightly more difficult than the excavation component of Alternative SED-4a, because the excavation would be in the boat dock area and equipment movement would be more challenging. A dewatering area would be required to allow the sediment to drain for Alternative SED-4b. Existing vegetation would need to be removed and restored after excavation for Alternative SED-4a. Because of the shallow excavation depth and nature of the wetlands buried utilities may not be affected. Alternative SED-4a would require mats to support excavation equipment.

Non-hazardous waste landfills for the off-site disposal of the sediment and stripped vegetation would be readily available.

The administration aspects of Alternatives SED-4a and SED-4b would be moderately difficult to implement. The off-site transportation and disposal of the excavated sediment and vegetation would require the completion of administrative procedures which could readily be accomplished. However, in order to perform excavation and reconstruction of a wetland during Alternative SED-4a and dredging during Alternative SED-4b, the involvement of the Army Corps of Engineers, FDEP and USEPA is required to properly permit construction activities. Special concerns are associated with the hydraulic dredging process for Alternative SED-4B. Hydraulic dredging requires the addition of polymers to the dredged sediment for pumping purposes. If the polymers and sediment bags are not compatible with one another, the sediment bags can clog and prevent the dewatering process. Settling basins can be used instead of sediment bags, but the dewatering using settling basins is significantly longer than with sediment bags because the sediment must fall through the water column rather than the water being filtered though the sediment bags. Additionally settling basins require the addition of flocculants to help speed up the settlement process. Due to the time associated with the dewatering process, this FS assumes the use of sediment bags rather than settling basins.

**Cost**

The capital and O&M costs and NPW of the sediment alternatives for all the wetlands are as follows.

| Alternative | Capital Cost | 30 Year NPW of O&M | 30 Year NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $208,000 | $400,000 | $608,000 |
| SED-3 | $208,000 | $1,362,000 | $1,570,000 |
| SED-4a | $17,388,000 | - | - |
| SED-4b | | - | - |

* Costs for Alternative SED-4b are included in the costs for Alternative SED-4a. These two alternatives will be conducted simultaneously.

# 1.0 INTRODUCTION

## 1.1 PURPOSE AND ORGANIZATION OF REPORT

This Feasibility Study (FS) Report for Operable Unit (OU) 16, Site 41 Wetlands at Naval Air Station (NAS) Pensacola, Florida, has been prepared by Tetra Tech NUS, Inc. (TtNUS) for Naval Facilities Engineering Command Southeast (NAVFAC SE) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62467-04-D-0055, Contract Task Order (CTO) 0030.

Site 41 encompasses approximately 81 wetlands or wetland complexes, both tidal and non-tidal, within the base boundary of NAS Pensacola. Based on results presented in the Final Site 41 Remedial Investigation (RI) Report (EnSafe, 2007a) and RI Report Addendum (EnSafe, 2007b), only Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64 have been retained for FS evaluation. The remaining wetlands have not been retained because the results of the RI indicate that those wetlands do not pose a threat to human or ecological receptors. This FS establishes Remedial Action Objectives (RAOs) and cleanup goals; screens remedial technologies; and assembles, evaluates, and compares remedial alternatives for contaminated sediment and surface water at these eight retained Site 41 wetlands.

This FS Report has been organized with the intent of meeting the general format requirements specified in the United States Environmental Protection Agency (USEPA) RI/FS Guidance Document (USEPA, 1988) and contains the following five sections:

- Section 1.0, Introduction, summarizes the purpose of the report, provides site background information, summarizes the findings of the RI, and provides the report outline.

- Section 2.0, Remedial Action Objectives and General Response Actions, presents the RAOs, identifies Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) criteria, develops groundwater cleanup goals for chemicals of concern (COCs) and associated General Response Actions (GRAs), and provides estimates of the volumes of contaminated sediment and surface water to be remediated.

- Section 3.0, Screening of Remediation Technologies and Process Options, provides a two-tiered screening of potentially applicable sediment and surface water remediation technologies and identifies the technologies that were assembled into remedial alternatives.

- Section 4.0, Assembly and Detailed Analysis of Remedial Alternatives, assembles the remedial technologies retained from the Section 3.0 screening process into multiple sediment and surface water remedial alternatives, describes these alternatives, and performs a detailed analysis of these alternatives in accordance with seven of the nine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) evaluation criteria.

- Section 5.0, Comparative Analysis of Remedial Alternatives, compares the sediment and surface water remedial alternatives on a criterion-by-criterion basis, for each of the seven CERCLA analysis criteria used in Section 4.0.

Appendix A contains ecological Preliminary Remediation Goals (PRGs) calculations, Appendix B contains contaminant mass calculations, and Appendix C contains the cost estimates for the developed alternatives.

## 1.2 OPERABLE UNIT 1 (SITE 1) SANITARY LANDFILL

Site 1 is an approximately 85-acre inactive sanitary landfill. The landfill was used from the early 1950s until 1976 for disposal of solid and industrial waste generated at NAS Pensacola as well as outlying Navy installations. The site received various wastes, such as polychlorinated biphenyls (PCBs), solvents, pesticides, oils, plating solutions, mercury, asbestos, paint chips and sludge, medical waste, pressurized cylinders, and household garbage. In addition, a tar pit was found on the western edge of the landfill and was the subject of a removal action. The site elevation is from 8 to 20 feet above mean sea level and is densely vegetated with 15- to 25-foot tall planted pines and natural scrub vegetation. The site is within the north central portion of the NAS Pensacola, approximately one-half mile east of Forrest Sherman Airfield. The landfill is bordered by an inland water body (Bayou Grande) to the north, by the A.C. Read Golf Course to the east, and by areas of natural scrub vegetation to the west and south. Bayou Grande has been classified by the Florida Department of Environmental Protection (FDEP) as a Class III water body, indicating its use for recreation and maintaining a well-balanced fish and wildlife population. Beyond the scrub vegetation, Taylor Road lies approximately 200 feet south of the site. Developed areas immediately north of the landfill include a Boy Scout camp, a nature trail, an NAS Pensacola picnic area, and recreational Buildings 3553 and 3487.

Because soil is highly permeable at the site, the potential for substantial contamination transfer via surface water flow is limited. Two intermittent creeks lie within wetlands outside the landfill. One creek, approximately 50 to 100 feet east of the landfill's central portion (depending upon precipitation amounts), channels flow northeastward to the beaver pond (Wetland 3). The other originates approximately 500 feet west of the landfill's central portion and channels flow northwestward to Bayou Grande. Neither has been observed to receive direct surface water runoff from the landfill; it appears that they are fed by groundwater seepage when the water table is high. A dry stream bed is in the site's northern portion, immediately south and leading to Bayou Grande Pond. No surface water was observed in this stream bed during the remedial investigation.

Buried waste in the landfill has been characterized in the RI as containing detectable concentrations of all analyzed parameter groups (inorganics, volatiles, semivolatiles, pesticides and PCBs). Surface soil quality outside the landfill boundary appears to generally compare to reference soil conditions. However, subsurface soil within the boundary appears to have been impacted by landfill activities, resulting in elevated concentrations of inorganic and organic constituents.

### 1.2.1 Shallow and Intermediate Groundwater

Groundwater in the surficial zone at Site 1 flows in an overall northward direction during both low and high tide, with components of flow to the north-northwest, northwest, and northeast toward Bayou Grande and other surface water features. This flow pattern generally mimics site topography, which is characteristic of unconfined surficial aquifers with high transmissivities.

The affected groundwater in the aquifer beneath OU 1 has been classified by USEPA and FDEP as Class IIA and G-2, a potential source of drinking water. The nature and extent of landfill-impacted groundwater have been evaluated onsite. Inorganic and organic constituents are present in the surficial zone (shallow and intermediate well depths) beneath the site. Groundwater analytical results from 1993 and 1994 indicate that 1993 analytical results were affected (biased) due to sample turbidity. The 1993 samples were collected with Teflon bailers, while 1994 samples were collected with quiescent sampling techniques. Based on 1994 analytical results, the greatest impact from inorganics to shallow and intermediate groundwater quality appears to be limited to the site's center, along the landfill's eastern, western, and northwestern boundaries. Except for aluminum, iron, and manganese (indicated by reference data to naturally occur at elevated concentrations), inorganic concentrations exceeding ARARs are generally limited to areas within and around the landfill perimeter.

Organic constituents have consistently been detected above standards in Site 1 surficial groundwater. Consistent with the distribution of elevated inorganics, the highest organic concentrations were detected in the site's center and along the eastern and western boundaries. Organic concentrations extend downgradient from the landfill to areas along Bayou Grande's coastline, adjacent wetlands, and east-northeast beneath the golf course. However, no elevated inorganic or organic concentrations (except for a single pesticide concentration) were detected in samples collected from the most downgradient monitoring well across the golf course opposite the landfill. This indicates that the extent of organic contaminant-impacted groundwater migrating east-northeast from the landfill is limited to the area beneath the adjacent golf course. As with inorganics, organic concentrations exceeding ARARs are generally limited to areas within and around the landfill's perimeter.

The wetlands associated with OU 1 include Wetlands 1, 3, 4D, 15, 16, 17, 18A and 18B. Wetlands 1, 4D, and 17 have not been retained for evaluation of remedial alternatives in this FS. However, for continuity in discussing OU 1 descriptions of these wetlands have been included in this discussion.

Figure 1-1 shows the location of all wetlands on a United States Geological Survey (USGS) 7.5-minute topographical map, and Figure 1-2 shows the wetland locations in relation to other facility features on a topographic map. Figure 1-3 shows Wetlands 3, 15, 16, 18A, and 18B locations in relation to Site 1.

### 1.2.2 Wetland 1

Wetland 1 is north of the intersection of Taylor and Tow Way Roads. The wetland is approximately 1,500 feet southwest of the center of Site 1 and approximately 900 feet southeast of Site 16. In 2003, the U.S. Department of Veterans Affairs expanded the Barrancas National Cemetery on the north side of Taylor Road. This cemetery expansion is near the southern border of Wetland 1A. Wetland 1A is the wetland, whereas Wetland 1B is the adjacent storm water ditch. The IR site potentially affecting Wetlands 1A and 1B is Site 1, while Wetland 1B may also be influenced by storm water discharges.

Wetland 1A is identified as a palustrine, forested system dominated by slash pines (*Pinus elliotti*). During the Site 41 investigation, both the wetland and a nearby drainage ditch were sampled. The ditch is a part of the NAS Pensacola storm water drainage system and conveys runoff to Bayou Grande. The ditch is under the auspices of the NAS Pensacola Storm Water Pollution Prevention Program (SWPPP). For this report, the wetland and ditch samples have been separated and will be discussed separately.

Wetland 1B is an adjacent, open storm water ditch. This drainage ditch begins at an outfall formed by twin 54-inch concrete pipes and merges downstream with Wetland W2. Sample locations 041M010301 and 041M010401 were collected just downstream from this outfall. A review of the NAS Pensacola SWPPP shows a system of underground concrete pipes leading to this outfall. Wetland 1B is currently being monitored under the SWPPP in accordance with the Florida Generic Permit. Because Wetland 1B will continue to be used as a storm water conveyance system, it is likely that the system will recontaminate itself after every rain event and continue to generate hazard quotient (HQ) exceedances for polynuclear aromatic hydrocarbons (PAHs).

### 1.2.3 Wetland 3

Wetland 3 is in the north central portion of NAS Pensacola, west of the A.C. Read Golf Course, and east of Site 1. This area is an old beaver pond that is a palustrine system with the predominant vegetation being scrub shrub emergent. Currently, the wetland consists of a highly vegetated emergent area characterized by sweet bay magnolias (*Magnolia virginian*), cattails (*Typha latifolia*), and saw grass (*Cladium jamaicense*). A shallow sheet flow of clear water drains from the southwest to the northeast through a culvert, which runs under John Tower Road, and beneath a golf course fairway into Wetland 4D, which empties into Bayou Grande. The open water portion of the wetland ranges from 0 to about 3 feet in depth and from 3 to 500 feet in width.

### 1.2.4 Wetland 4D

Wetland 4D is in the northern portion of the eastern half of NAS Pensacola. It is bound on the west, south, and east by the A.C. Read Golf Course and on the north by Bayou Grande. Wetland 4D is fed by Wetland 3 from the west, Wetland 4C from the south, and is tidally influenced by Bayou Grande from the north. Groundwater from western adjacent Site 1 also flows toward this wetland. This wetland is described as an estuarine system with emergent vegetation. Saw grass and black needle rush are the prominent vegetative features at this wetland. Wetland 4D receives freshwater from surface water discharges from Wetland 3 and Wetland 4C via Wetlands 4A and 4B (Wetland 4A encompasses an irrigation reservoir for the golf course and drains into Bayou Grande through Wetlands 4B, 4C, and 4D). The open water portion of the wetland ranges from 1 to about 8 feet in depth and has a maximum width of about 70 feet. Sediment in most of the wetland is sandy.

### 1.2.5 Wetland 15

Wetland 15 is on the shore of Bayou Grande, just northeast of Site 1, between Wetland 4D and the NAS Pensacola Picnic Ground. This wetland is bordered by the A.C. Read Golf Course to the south, east, and west, and Bayou Grande to the north. Wetland 15 is fed from the south by surface water runoff from the area of the golf course and from the north by tidal influences from Bayou Grande. Site 1 groundwater also flows toward this wetland.

Wetland 15 is an estuarine emergent system, with predominantly *Juncus romerianus*. Wetland 15 generally flows north into Bayou Grande through a drainage channel about 3 feet wide. The open water portion of the wetland ranges from 1 to about 3 feet in depth and has a maximum width of about 300 feet. Sediment in the wetland is highly organic, with total organic carbon (TOC) levels detected up to 40%. The mowed grass and abrupt topography, between the wetland and golf course, make the border between open water and upland obvious.

### 1.2.6 Wetland 16

Wetland 16 is on the northern side of Site 1, along the shore of Bayou Grande. The NAS Pensacola picnic ground lies to the east. The area is an estuarine emergent system containing predominantly black needle rush *(Juncus romerianus)* and saw grass *(Cladium jamaicense)*. Wetland 16 generally flows northwest into Bayou Grande through a drainage channel about 3 feet wide. The open water portion of the wetland ranges from 1 to about 4 feet in depth and has a maximum width of about 200 feet.

Wetland 16 is fed from the south and southeast by groundwater from the area of Site 1 and from the northwest by tidal influences from Bayou Grande. Rubble deposits to the south, from Site 1 and other abrupt transitions, make the border between open water and upland obvious.

### 1.2.7 Wetland 17

Wetland 17 is along the northern portion of the base, along the eastern shore of Redoubt Bayou. A wooden gazebo used as a part of the Nature Trail sits adjacent to this wetland. Wetland 17 is approximately 1,200 feet northwest of the Site 1 landfill.

Wetland 17 is an estuarine system with emergent vegetation. This tidally influenced area is roughly two-thirds of an acre in size and dominated with *Juncus roemeranus*. This area contains standing water approximately 3 feet deep during high and low tides.

### 1.2.8 Wetland 18

Wetland 18 is adjacent to the eastern shore of Redoubt Bayou, which is along the northern shoreline of Bayou Grande, situated at the midpoint of Pensacola NAS. Wetland 18 is influenced by Site 1 due to its proximity to that area. Wetland 18 is divided into two parts, A and B. Wetland 18A is classified as a palustrine emergent system, and Wetland 18B is classified as an estuarine emergent system. Wetland 18A is fed by groundwater seeps from Site 1 to the east and is a long narrow finger-shaped wetland running east to west. Wetland 18A, which is no deeper than a foot, and has a maximum width of 2 feet, transitions to Wetland 18B via a stream, approximately 2-feet wide, and located to the west. Wetland 18B is at the mouth of Wetland 18 and Redoubt Bayou and ranges from 1-foot to 8 feet deep, with a maximum width of 50 feet. Redoubt Bayou borders Wetlands 18A and 18B to the west, and Site 1 borders the wetlands to the east. This entire system is very shallow with occasional surface flow due to the tides. The wetland also receives freshwater flow from a small surface water drainage pattern.

### 1.2.9 Ecological Risk Assessment

All the OU 1 wetlands are evaluated collectively to help determine where the highest probabilities of unacceptable risk may occur and whether risk is likely to be related to exposure from OU 1 at NAS Pensacola. For OU 1, the tools that best evaluate risk on an OU-wide basis include:

- **Food-Chain Models (FCMs):** Many of the upper-level predators likely to be present within Site 41 wetlands, could be exposed to constituents from more than one wetland. To evaluate this scenario, food-chain models were conducted on an OU-wide basis.

- **Effects Range Mean (ERM) Quotients:** This methodology is an effective way to pinpoint areas of potential excess risk from a mixture of constituents. It is also useful in identifying locations most likely to be impacted by direct toxicity.

- **Basewide Total DDT-Level Comparison:** A base-wide level for total DDT was established at NAS Pensacola. A comparison of site concentrations to the basewide level was presented.

- **TOC-Normalized PAH Concentrations:** PAHs are widespread across NAS Pensacola and have been evaluated based on their potential for adverse effects, when the TOC at each sample location is considered.

- **TOC-Normalized Volatile Organic Compound (VOC) Concentrations:** The article *Technical Basis for Narcotic Chemicals and PAH Criteria. II. Mixtures and Sediments* (Di Toro, J. M. and J. A. McGrath, 2000b) explains how TOC-normalized VOC concentrations in sediment can be compared to Equilibrium Partitioning Quotient (EqP) Sediment Quality Guideline (SQGs) to develop HQs for evaluation of potential sediment toxicity. Since wetland-specific TOC is available for this site, each Di Toro SQG is normalized based on the amount of organic carbon present at each location (rather than 1% as in the original methodology). At wetlands where TOC is not available for each sample location, the lowest TOC measured in that wetland is used as a conservative surrogate.

### 1.2.10 OU 1 Food-Chain Modeling

To evaluate the potential for risk to upper-trophic-level receptors that forage within the wetlands surrounding OU 1, food-chain models were prepared. The wetlands in this evaluation include:

- Wetland 1
- Wetland 3*
- Wetland 4D
- Wetland 15
- Wetland 16*
- Wetland 17
- Wetland 18A and 18B*

Those wetlands with an asterisk were resampled and evaluated using both the original Phase II data, as well as the Phase III data. During Phase III, fish tissue was collected at Wetland 18B and was included in the food-chain models. Food chain models were evaluated for three assessment endpoints as described below.

The following constituents were evaluated in these food-chain models:

- Pesticides (total BHCs, total DDT, total chlordanes, total endrin, and dieldrin)
- Total PCBs
- Mercury

#### 1.2.10.1 Assessment Endpoint 1 — Health and Viability of Piscivorous Bird Communities, that Forage in OU 1 Wetlands

Phase II Evaluation

The Phase II data indicated estimated daily doses of mercury and total DDT generate HQs greater than 1. Based on this exposure, there is some potential for unacceptable risk to piscivorous bird communities that feed exclusively from wetlands within OU 1. The daily dose for piscivorous birds was calculated, using the site-specific sediment and surface water concentrations and an estimated prey concentration based on literature Biota Sediment Accumulation Factor (BSAFs).

Total DDT HQs for piscivorous birds ranged from 9.68 [max concentration/ no observed adverse effects level (NOAEL)] to less than 1 [average concentration/lowest observed adverse effects level (LOAEL)]. The maximum concentration of total DDT (2.4 mg/kg) was detected in Wetland 18A at sample location 041M18A101. Total DDT was detected in each of the OU 1 wetlands, except for Wetland 17. The two highest concentrations of total DDT were both located in Wetland 18 (2.4 mg/kg at 041M18A101 and 2.1 mg/kg at 041M18B101). Wetland 18 was selected as a wetland for sampling during Phase III. During this round of sampling, fish tissue was collected from location 041M18B101 to evaluate the site-specific bioaccumulation of constituents detected in sediments.

No other constituents generated food-chain model HQs greater than 1 based on estimated exposure to piscivorous birds.

Phase III Evaluation

During Phase III, sediment and surface water sampling was conducted along with fish tissue collection. Wetlands 3, 16, and 18B were resampled, and forage fish were collected at Wetland 18B. The site-specific tissue data replaced the estimates used in the Phase II food-chain models. Using the site-specific data collected during Phase III, no constituents generated food-chain model HQs greater than 1.

#### 1.2.10.2 Assessment Endpoint 2 — Health and Viability of Piscivorous Mammal Communities that Forage in OU 1 Wetland

Phase II Evaluation

The Phase II data indicate concentrations of mercury generating HQs greater than 1 based on an estimated daily dose. Based on this exposure, there is some potential for unacceptable risk to piscivorous bird communities that feed exclusively from wetlands within OU 1. The daily dose for piscivorous birds was calculated, using the site-specific sediment and surface water concentrations and an estimated prey concentration based on literature BSAFs.

The mercury HQs for piscivorous mammals exceeds 1 and indicates the potential for unacceptable risk. Mercury HQs range from 4.51 (maximum concentration/NOAEL) to 0.17 (average concentration/LOAEL). Mercury was detected in Wetlands 1, 4D, and 16, with the maximum concentration detected in Wetland 16 (0.41 mg/kg at sample location 041M16020A). Dieldrin generated a HQ of 1.2 (max concentration/NOAEL) and 0.005 (average concentration/LOAEL). The maximum sediment concentration of dieldrin was detected at Wetland 1A. No other constituents generated an HQ greater than 1 for piscivorous mammals within OU 1.

Phase III Evaluation

During Phase III, mercury was detected in three of the four sediment samples collected, with the maximum concentration of (0.1 mg/kg in Wetland 3 (041M030201). The fish tissue collected in Phase III was not analyzed for mercury. Therefore, fish tissue samples collected in the area of Wetland 18B for the Site 40, Bayou Grande, remedial investigation (EnSafe, 1999), have been used to fill this data gap. No contaminants of potential concern (COPCs) generated any FCM HQs greater than 1 for piscivorous mammals.

#### 1.2.10.3 Assessment Endpoint 3 — Health and Viability of Predatory Fish Communities that Forage in OU 1 Wetland

This assessment endpoint was evaluated using the Evans and Engels food-chain model for mercury. Using the Phase II sediment concentrations, this model generated HQs for mercury ranging from 7.02 (max concentration/NOAEL) to 1.88 (average concentration/LOAEL), indicating the potential for unacceptable risk to predatory fish.

Mercury concentrations identified during the Phase III sampling event were used in the food-chain models. The mercury HQs for OU 1 wetlands range from 1.31 to 0.37, indicating that the maximum concentration poses unacceptable risk. However, according to the food-chain models, the maximum concentration location is the only sample location that poses unacceptable risk to predatory fish, using the most recent data.

<u>Food-Chain Modeling Summary for OU 1</u>

Based on the site-specific biota tissue sampling conducted at Wetlands 3, 16, and 18, the assessment endpoint identified with the potential for risk was predatory fish. The maximum NOAEL HQ for this endpoint was 1.37 and the maximum LOAEL HQ is 0.65, assuming that all exposure occurred at the location of the maximum concentrations. However, evaluating exposure at the average concentration measured in the OU 1 wetlands generates a NOAEL HQ of only 0.74.

<u>Mean ERM Quotients</u>

Sample locations in Wetlands 1B, 4D, 15, 16, and 18A were identified as Category 3 in Phase II. The primary constituents exceeding individual ERMs included total DDT (and daughter products) within each wetland, cadmium (limited to Wetland 3), and several others only detected once (lead and PCBs). However, when the Phase III sampling was conducted, reductions in constituent levels resulted in the Phase II Category 3 locations being reduced to Category 2. Although several ERM exceedances are noted in the Phase II samples, only one constituent — (total DDT) — exceeded its ERM during the Phase III sampling event and only at one location. These results indicate direct toxicity resulting from exposure to OU 1 wetland sediments is not likely (although it is possible) at any of the Phase III sampling locations.

During Phase II, the constituent most frequently exceeding its ERM was total DDT (and its daughter products). Cadmium also exceeded its ERM in Phase II in one of 10 sample locations. Of the four sample locations selected for sediment toxicity testing in Wetlands 3, 16, and 18B during Phase III — 41M030201, 41M030701, 41M160301, and 41M18B101 — the only statistically significant toxic effect noted was in Wetland 3 (sample location 41M030701). The two constituents that generated the highest screening and refinement HQs in Wetland 3 were cadmium (9.3 mg/kg) and total DDT (69.3 µg/kg).

Wetland 3 was the only wetland with detected cadmium concentrations that generated screening HQs greater than 1, which indicates exposure to cadmium is not an issue at any other wetland in OU 1.

Basewide Total DDT Levels

During Phase II sampling, Wetlands 3, 4D, 15, 18A, and 18B all had at least one sample exceeding the base-wide total DDT level. Because Phase III sampling was not focused on total DDT results, many of these exceedances were not resampled. Of the OU 1 locations that were resampled during Phase III, the only location sampled exceeding the base-wide level was in Wetland 18B.

TOC-Normalized PAH Concentrations

During the Phase II sampling, the only wetlands with locations exceeding the Swartz Threshold Effects Concentration (TEC) were Wetlands 1B (two locations) and 4D (one location). None of the locations exceeded the Swartz Extreme Effects Concentration (EEC), which indicates a virtual certainty of adverse effects. During the Phase III sampling event, only Wetland 16 had a sample location exceeding the Swartz TEC. However, in the site-specific toxicity testing conducted in Wetland 16 at sample location 041M1603, no statistically significant differences were noted, when compared to the control.

**TOC-Normalized VOC Concentrations:** None of the OU 1 VOC detections generated an HQ greater than 1.

#### 1.2.10.4 Conclusions

Using all the lines of evidence provided for in this risk assessment, unacceptable risk has been identified at Wetland 3 for direct toxicity. However, because of the significantly different analytical results between Phase II and III and the limited number of sampled collected during Phase III, the Navy is evaluating remedial alternatives for Wetlands 15, 16, and 18 based on the Phase II results in this FS.

## 1.3 OPERABLE UNIT 2 AND ASSOCIATED WETLANDS

OU 2 is located in the northeastern portion of the base and is roughly 300 acres in size. OU 2 includes Sites 11 (North Chevalier Disposal Area), 12 (Scrap Bins), 25 (Radium Spill Area), 26 (Supply Department Outside Storage Area), 27 (Radium Dial Shop), and 30 (Building 649 Complex). The OU 2 investigation also included a portion of the former industrial waste water treatment plant (IWTP) sewer line serving the OU 2 area. The Site 41 wetlands associated with OU 2 include Wetlands 5A, 5B, 6, and 64. Wetlands 5B and 6 have not been retained for evaluation of remedial alternatives in this FS. However, for continuity in discussing OU 2 descriptions of these wetlands have been included in this discussion.

Figure 1-4 shows the locations of Wetland 5A. Wetland 64 is an approximately 41-acre area on the eastern shore of the upstream side of the NAS Pensacola Yacht Basin, which is in the northeastern quadrant of the base (Figure 1-4).

### 1.3.1 Wetland 5

Wetland 5, a wooded area within the developed portion of NAS Pensacola, is flanked to the west by the A.C. Read Golf Course, to the north by the former Naval Aviation Depot (NADEP) Dynamic Components Division (Building 649 Complex) and other buildings formerly used by NADEP, and to the south by Taylor Road. Wetland 5 is divided into two parts, 5A and 5B. Wetland 5A is a palustrine forested system, and Wetland 5B is a palustrine emergent system.

Wetland 5A (roughly 1.3 acres in size) is connected to Wetland 5B (1.2 acres) by a culvert, which runs under Murray Road. Wetland 5A is bordered by Murray Road to the east, the golf course to the west, and buildings to the north and south. A 200-300 foot vegetative buffer surrounding this area likely offers habitat to various species. The open water portion of the wetland ranges from zero to three feet in depth and varies from 80-150 feet in width.

Little history is available concerning the origins of Wetland 5A, which is several decades old and likely began as a man made feature (a borrow pit). It served as a drainage pathway as early as the 1930s and reportedly contained a saw mill during the 1940s. A 1939 map of the base labeled Wetland 5 as an “open ditch.” In recent years, beaver dams constructed at the downstream end of Wetland 5A raised the water level in the basin containing this wetland, facilitating sedimentation and the emergence of a marsh. After a faulty valve in a nearby potable water storage tank was repaired in 1994, the water level in Wetland 5A has significantly receded. Previously, several thousand gallons of potable water per day accidentally discharged from this tank into Wetland 5A via an overflow pipeline. Wetland 5A continues to serve as a storm water conduit. NAS Pensacola Storm Drainage Map 1276912 shows three outfalls in Wetland 5A. Outfall T discharges storm water from the Bachelor Officers’ Quarters area to the south. Outfall V and an unnamed outfall discharge storm water from the former Building 649 Complex. Wetland 5A drains via Wetland 5B into Wetland 6, which empties into the NAS Pensacola Yacht Basin (Wetland 64). Typical vegetation found in Wetland 5A consists of hardwoods, such as oaks and sweet bay magnolias.

Wetland 5B resembles and functions as a drainage ditch. It receives storm water from Wetland 5A and drains eastward into Wetland 6. NAS Pensacola Storm Drainage Map 1276912 shows one outfall in Wetland 5B, which discharges storm water from the Building 3220 area. Vegetation in Wetland 5B includes cattails *(Typha latifolia)* and other emergent plants. Routine maintenance of the ditch includes removal of vegetation, debris, and sediment to allow for storm water flow.

OU 2 sites with the greatest potential to impact Wetland 5 include Sites 30 and portions of the IWTP sewer line. Buildings 649 and 755 (Site 30) are north and upgradient of Wetland 5, and are separated by a service road, driveway and a parking lot. Building 649 was used from the 1940s to the 1950s as a tin-cadmium plating operation. Fifteen above-ground tanks near Building 649, ranging from 200 to 500 gallons, contained solutions of tin, cadmium, and cyanide. Additionally, a 250-gallon tank stored 1,1,1-trichloroethylene (TCE). The contents of these tanks reportedly were dumped monthly into a "ditch" east of the building. Based on current topography and historical data, this "ditch" was either the wetland itself, or the wetland was directly fed by the ditch. During the 1960s and 1970s, the 15 tanks stored phosphoric acid, caustics, potassium permanganate, degreasers, and chromate solutions, which were also periodically drained into the "ditch". According to historical data, the concentrated cyanide solutions were placed into a tank truck, transported to the Building 709 plating shop, and disposed of in the sanitary sewer. Plating operations in Building 649 ceased in the 1970s.

Building 755 also operated as a plating shop during the 1960s and 1970s. It had approximately 50 above-ground tanks ranging from 50 to 200 gallons in volume and containing plating solutions of nickel, silver, lead, tin, chromium, and other metals. These tanks were also reportedly periodically drained into the "ditch" east of Building 649. Building 755 plating operations ceased in the 1970s (EnSafe, 1997b).

The IWTP sewer line in the OU 2 area was investigated in conjunction with OU 2. The sewer line runs from the OU 2 area along Wetlands 5 and 6 to the IWTP (OU 10). The wastewater treatment plant, originally built in 1948, was replaced in 1971 with a modern plant that could accept industrial wastes. Most facilities discharging to the sewer did so without any pretreatment or waste segregation. The waste stream has included paint strippers, heavy metals, pesticides, radioactive wastes, fuels, cyanide waste, and waste oil (NEESA, 1983). Beginning in 1973, the Naval Air Rework Facility operations discharged to the sewer instead of to Pensacola Bay. The IWTP sewer line consisted of vitreous clay and cast-iron piping installed both before and after 1971.

### 1.3.2 Wetland 6

Wetland 6 is a tidally influenced tile-lined drainage ditch that originating at the parade grounds north of the NAS Chapel and draining to the north into the Wetland 64 complex. Wetland 6 receives surface water from Wetland 5 and the area associated with the former Chevalier Field area [now Naval Air Technical Training Center (NATTC)]. Wetland 6 is a palustrine wetland with open water. This wetland is bound by mowed grass, buildings, or isolated areas of highly disturbed vegetation. The ditch portion of Wetland 6 is no deeper than about 3 feet and has a maximum width of about 3 to 5 feet. Wetland 6 eventually drains into the Yacht Basin, Wetland 64 complex and is tidally influenced along its entire length. Routine maintenance of the ditch includes removal of vegetation, debris and sediment to allow for storm water flow. In addition damaged tiles along the ditch are replaced as needed.

Sites with the greatest potential to have impacted Wetland 6 included Sites 12 and 30 of OU 2, OU 6 (Sites 9, 29, and 34), and Sites 10 and 36. All of these sites are adjacent or near to this wetland. OU 6, Site 10 and Site 36 were all approved for no further action. Potential impacts from OU 2 media are discussed in Section 1.3.4.

### 1.3.3 Wetland 64

Wetland 64 is an approximately 41-acre area on the eastern shore of the upstream side of the NAS Pensacola Yacht Basin, which is in the northeastern quadrant of the base. For the Site 41 RI, the Wetland 64 complex investigation incorporated several areas surrounding NAS Pensacola Yacht Basin: the southeast shore of the Yacht Basin, the open water area of the Yacht Basin, and adjacent Wetlands 7 and 8. The open water portion of the Wetland 64 complex is approximately 20 acres in size, ranging from about 2 to 15 feet in depth, and is 600 to 900 feet wide. The turning basin area in the open water portion is routinely dredged. Dredged material is deposited on Magazine Point on the east site of the Yacht Basin. Adjacent Wetland 7 encompasses the downstream end of the tile-lined storm water conduit (Wetland 6) that drains into the Yacht Basin. Wetland 6 drains storm water runoff from the area directly around NATTC and the NAS Chapel. The NATTC was previously the Naval Aviation Depot or NADEP. Wetlands 5A and 5B (Section 11.1) contribute additional discharge to Wetland 6 (Section 11.2), which ultimately discharges into Wetland 64.

Adjacent Wetland 8 includes the western shore of Magazine Point. The western shore of the Yacht Basin also contains the NAS Pensacola Yacht Club and marina. A concrete seawall exists along the shoreline of the marina, from which several docks housing numerous boats extend into the Yacht Basin. The western shore of the Yacht Basin also contains buildings, a paved parking area, a fenced area for boat storage, and road access. The eastern bank of the Yacht Basin remains relatively undisturbed.

Evaluation of maps and aerial photography from 1939 and 1951 reveal the Wetland 64 area was once approximately one-third larger than the current area. Sometime after 1939, approximately 15 acres in the southwest portion [the area now encompassing Installation Restoration (IR) Site 11, North Chevalier Disposal Site], and approximately 10 acres along the west side (the area now containing the building and parking areas associated with the Yacht Basin), were filled; apparently coincident with the construction of the marina. The filled area along Site 11 constricts the width of the open water portion of Wetland 64 to approximately 8 to 10 feet from where Wetland 6 discharges into this water body to the southern end of the marina.

IR sites potentially affecting Wetland 64 include Site 10, OU 2 (Sites 11, 12, and 30), and OU 6 (Sites 9, 29, and 34). OU 6 and Site 10 were approved for no further action. Potential impacts from OU 2 media are discussed in Section 1.3.4.

### 1.3.4 Potential Impacts from Operable Unit 2 Media to Wetlands 5, 6 and 64

In 2003, soil and groundwater data were collected at OU 2 and compared to analytical data collected in the 1993 to 1995 remedial investigation to document changes and to support the OU FS. The data are summarized in the *RI Addendum OU 2 Report* (EnSafe, 2004c).

Groundwater metals data indicate migration to surface water continues to be a potential issue for Wetlands 5A, 5B, 6, and 64 for a number of metals, including cadmium, chromium, iron, and manganese (EnSafe, 2004c). Soil may be continuing source of metals in groundwater at Site 11.

Since the 1993-1995 RI sampling event, there has been a decrease in both soil and groundwater concentrations for pesticides and PCBs at OU 2. The pesticide and PCB data do not indicate a continuing issue with respect to the soil-to-groundwater pathway, nor the groundwater-to-surface water pathway (EnSafe, 2004c).

The soil data for semi-volatile organic compounds (SVOCs) indicate there may be a continuing issue with the soil-to-groundwater pathway at isolated locations on Sites 11 and 27. The groundwater data indicate there continues to be a potential issue for SVOCs with respect to the groundwater-to-surface water pathway at Site 11 (Wetlands 6 and 64), the southeast corner of Site 30 (Wetlands 5B and 6), and Site 30 near Wetlands 5A and 5B.

For VOCs, the soil data indicate there is not a continuing issue with the soil-to-groundwater pathway (EnSafe, 2004c). However, groundwater data indicate there continues to be a potential issue for VOCs with respect to the groundwater-to-surface water pathway at OU 2 on Sites 30 and 11 at following wells: 030GS111 and 030GI111 adjacent to the southern end of Wetland 6; 030GS18, adjacent to Wetland 5A; 030GS06, adjacent to Wetland 5A; 030GI170, adjacent to Wetland 5B; 011GS52, adjacent to the central portion of Wetland 6; 011GI114, adjacent to the northern portion of Wetland 6; 011GI12, adjacent to the northern portion of Wetland 6; 011GI10, adjacent to the southern portion of Wetland 64 complex; and 011GS47 and 011GS28, both adjacent to the Wetland 64 complex (EnSafe, 2004c).

Remedial alternatives were evaluated in the OU 2 FS and the selected remedies were presented in the OU 2 Record of Decision (ROD). The soil remedy selected for OU 2 was Excavation and Offsite Disposal with Land Use Controls (LUCs). The groundwater remedy selected for OU 2 was monitored natural attenuation with LUCs. A Trident probe investigation is planned to assess the groundwater to surface water interface at Wetlands 5A, 5B, and 64.

### 1.3.5 Ecological Risk Assessment

All the OU 2 wetlands were evaluated collectively to assess where the highest probabilities of unacceptable risk may occur and whether that risk is likely to be related to exposure from IR sites at NAS Pensacola. In the case of OU 2, the tools that best evaluate risk on an OU-wide basis include:

- **Food-Chain Models:** Many of the upper level predators likely to be present within Site 41 wetlands could be exposed to constituents from more than one wetland. To evaluate this scenario, FCMs were conducted on an OU-wide basis.

- **Mean ERM Quotients:** This methodology was an effective way to pinpoint areas of potential excess risk from a mixture of constituents. It was also useful in identifying locations most likely to be impacted by direct toxicity.

- **Basewide DDT-Level Comparison:** A basewide level was established for DDT at NAS Pensacola. A comparison of site concentrations to the basewide levels was completed.

- **TOC-Normalized PAHs Concentrations:** PAHs are widespread across NAS Pensacola and were evaluated based on their potential for adverse effects when the TOC at each sample location is considered. This method was used to identify locations where PAHs may occur at levels most likely to cause adverse effects.

- **TOC-Normalized VOC Concentrations:** The article *Technical Basis for Narcotic Chemicals and PAH Criteria. II. Mixtures and Sediments* (Di Toro, J. M. and J. A. McGrath, 2000b) explains how TOC-normalized VOC concentrations in sediment can be compared to EqP SQGs to develop HQs for evaluation of potential sediment toxicity. Since wetland-specific TOC is available for this site, each Di Toro SQG is normalized based on the amount of organic carbon present at each location (rather than 1% as in the original methodology). At wetlands where TOC is not available for each sample location, the lowest TOC measured in that wetland is used as a conservative surrogate.

To evaluate the potential for risk to upper-trophic-level receptors that forage within the wetlands surrounding OU 2 — food-chain models were completed. The wetlands in this evaluation include:

- Wetland 5A*

- Wetland 5B*
- Wetland 6
- Wetland 64*

Those wetlands with an asterisk were resampled and are evaluated using both the original Phase II data as well as the Phase III data. During Phase III (September 1997) and later in 2001, fish tissue was collected at Wetland 64 and was included in the food-chain models. Food chain models were evaluated for three assessment endpoints as described below. The following constituents were evaluated in these food-chain models:

- Pesticides (total BHCs, total DDT, total chlordanes, and total endrin)
- Total PCBs
- Mercury

#### 1.3.5.1 Assessment Endpoint 1 — Health and Viability of Piscivorous Bird Communities that Forage in OU 2 Wetlands

Phase II Evaluation

The Phase II data indicated that concentrations of mercury generate HQs greater than 1 based on an estimated daily dose. No tissues were collected during Phase II, so this daily dose was estimated using literature-based BSAFs to estimate prey concentrations using OU 2 sediment concentrations. The only exposure concentration that generated an HQ greater than one was the maximum total DDT concentration (maximum concentration/NOAEL HQ = 1.58). This sample was located in Wetland 6 at location 041M60101. Based on these estimated mercury exposure concentrations there is a potential for unacceptable risk to the piscivorous bird communities foraging in OU 2 wetlands. This Phase II data was the basis for the Phase III and later sampling events.

Phase III Evaluation

Using the data collected during Phase III, 2001, and 2004 events, no constituents included in the FCM indicated unacceptable levels via bioaccumulation through the food web. In 1997, six sediment samples were collected from OU 2 wetlands (three from Wetland 5A and three from Wetland 64). Of those samples, fish tissue was collected in Wetland 64 (at sample location 041M640101 and 041M6400601); however, the analysis of these samples did not include mercury. In 2001, fish tissue samples were collected from seven locations in Wetland 64 and analyzed for full analytical scans (including mercury). These tissue concentration results were used in the OU 2 food-chain models to replace the BSAF-derived prey concentrations used in Phase II.

### 1.3.5.2 Assessment Endpoint 2 — Health and Viability of Piscivorous Mammal Communities that Forage in OU 2 Wetlands

Phase II Evaluation

The Phase II data indicated that concentrations of mercury and PCBs generate HQs greater than 1 based on a maximum estimated daily dose. This daily dose is based on site-specific sediment and surface water concentrations and literature-based BSAFs for tissue concentrations. Using the maximum mercury exposure concentrations, the NOAEL HQs exceeded 1 (HQs=3.47), all other evaluations generated HQs less than 1. The maximum mercury sediment concentration was detected in Wetland 5A. The maximum PCB exposure concentrations also generated a NOAEL HQ of 2.8 and a LOAEL HQ of 1.4. PCBs were detected in all three OU 2 wetlands, with the maximum concentration in Wetland 64 (041M640301). No other constituent generated any FCM HQ greater than 1.

Phase III Evaluation

When the site-specific exposure concentrations were updated using the Phase III data (as explained above), no constituent produced a HQ greater than 1 indicating no adverse effects to piscivorous mammals are expected through accumulation via the food web.

### 1.3.5.3 Assessment Endpoint 3 — Health and Viability of Predatory Fish Communities that Forage in OU 2 Wetlands

The Evans and Engels exposure model for mercury was used to evaluate risk to predatory fish communities. The results are summarized below.

Phase II Evaluation

The Phase II data indicate that concentrations of mercury in the OU 2 wetlands generated HQs greater than 1 based on estimated concentrations of prey items. The HQs generated for OU 2 wetlands ranged from 17.13 (maximum concentrations/NOAEL) to 1.8 (average concentrations/LOAEL). Based on these estimated mercury exposure concentrations, there is a potential for unacceptable risk to predatory fish foraging in OU 2 wetlands.

Phase III Evaluation

Using the data collected during Phase III, 2001, and 2004 events, exposure estimates and the resulting HQs decreased. The HQs generated using these data range from 3.54 (maximum concentrations/

NOAEL) to 0.64 (average concentrations/LOAEL) for the OU 2 wetlands. The highest mercury concentrations detected were located at the three sample IDs within Wetland 64. This evaluation replaced the estimated fish tissue concentrations with site-specific concentrations. However, the majority of the reduction in HQs results from generally lower mercury concentrations identified during later sampling events.

#### 1.3.5.4 Mean ERM Quotients

Wetlands 5A, 5B, and Wetland 64 contained numerous sample locations that fall into mean ERM categories 3 and 4. Those locations consistently had concentrations of cadmium, chromium, and lead that exceed their respective ERM values. Because these exceedances represent conditions that would be expected to cause adverse effects on benthic macroinvertebrates, this area was selected for site-specific toxicity testing. Based on the mean ERM quotient category evaluation, the area adjacent to Site 11 seems to be an area where constituents have consistently exceeded ERM levels. Wetland 5 had very high concentrations of constituents when originally sampled during Phase II; however, those levels have not been repeated in two additional rounds of sampling in that wetland. As a result, it does not appear that Wetland 5A is acting as a constant source for Wetlands 5B and 64.

The results of those toxicity tests showed survival at less than 80 percent for *Leptocheirus* (78% survival at 041M640401 and 74% at 041M640601) and statistically significant impacts to growth in *Neanthes* (at 041M640501). The results of these site-specific toxicity tests verify adverse effects are occurring at the southern portion of Wetland 64.

#### 1.3.5.5 Base-wide DDT Comparison

Total DDT has exceeded its basewide levels at Wetlands 5A, 6, and the southern portion of 64. Although DDT does exceed its basewide level, food-chain models using site-specific tissue concentrations did not indicate the levels present in OU 2 are of concern for upper-trophic-level predators.

#### 1.3.5.6 TOC-Normalized PAHs

None of the sample locations within OU 2 exceeded the Swartz EEC indicating a virtual certainty of adverse effects from TOC normalized PAHs. However, four locations in Wetland 5A (one during Phase II and three during Phase III), and three locations in Wetland 64 (all in the southern portion of the wetland) exceeded the Swartz TEC, indicating the potential for adverse effects from PAHs. When these results were compared to the site-specific toxicity sampling conducted during Phase III, statistically significant differences were found at 5A05 and 5A06. Although no statistically significant differences were identified at Wetland 64, two of the locations (6404 and 6406) had a *Leptocheirus* survival of less than 80%. These results simply indicate that toxicity at these locations could be driven in part or in whole by PAHs identified in the sediments.

#### 1.3.5.7 TOC-Normalized VOCs

Only one location had a VOC HQ greater than 1. In Wetland 6, the detected acetone concentration of 4,000 µg/kg at location 0410608 generated an HQ of .

#### 1.3.5.8 Conclusions

Using all the lines of evidence presented in the ecological risk assessment, the areas of primary concern are the southern portion of Wetland 64 and Wetland 5A. Direct toxicity to the benthic community in Wetlands 5A and 64 and uptake of mercury in predatory fish in Wetland 64 are evaluated in this FS.

## 1.4 REMAINING WETLANDS

The wetlands grouped as “Remaining Wetlands” are Wetlands 19 (A and B), 56, 57, 58, W2, 48, and 49. These wetlands are across the western portion of NAS Pensacola near Forrest Sherman Field. Associated IR sites include:

- Site 1 (OU 1) — Sanitary Landfill
- Site 4 — Army Rubble Disposal Area
- Site 5 — Borrow Pit
- Site 6 — Fort Redoubt Rubble Disposal Area
- Site 16 — Brush Disposal Area
- Site 39 (OU 12) — Oak Grove Campground

Associated petroleum sites include Site 19 (Fuel Farm Pipeline Leak), Site 37 (Sherman Field Fuel Farm Area) and UST 18 (Crash Crew Training Area).

### 1.4.1 Wetland 48

Wetland 48 is the only wetland in the Remaining Wetlands Group retained for evaluation in the FS. Wetland 48 is in a mostly undeveloped portion of NAS Pensacola, north of Radford Boulevard, and south of the NAS Pensacola Fuel Farm (Figure 1-5). It is a thickly vegetated palustrine forested wetland.

The IR site potentially affecting Wetland 48 is Site 37. Site 37 (Sherman Field Fuel Farm Area) is located south of the western end of Forrest Sherman Field. The site consists of an approximately 3.5-acre, fenced area around the former fuel farm including four cut-and-cover storage tanks (Tank Nos. 1884, 1886, 1887, and 1888). The petroleum storage tank system was installed in 1945 and used to store JP-4 Jet Fuel. The fuel storage tanks were abandoned in place in 1995 after a new fuel facility was constructed adjacent to the south side of the original fuel farm. An equipment malfunction in 1983 resulted in the release of approximately 48,000 gallons of JP-4 Jet Fuel. Initial recovery efforts by NAS Pensacola personnel included the installation of four recovery ditches along the fence line in the northwestern corner resulting in the recovery of approximately 600-700 gallons of free product. However, recovery efforts were discontinued by direction of the NAS Pensacola Fire Marshall due to the proximity of open excavations containing free product to the active fuel farm area. Additional recovery efforts in August 1983 included the installation of a product/groundwater recovery well system from approximately 50 to 140 feet west-northwest of the fuel farm. The system proved unsatisfactory, apparently due to its location, and recovery operations were discontinued.

Wetland 48 is a palustrine forested system and is fed by surface water and groundwater. Surface water drains to the east into Wetland 52, passing through a culvert under the access road to the fuel farm. Groundwater flow in the area is to the southeast.

<u>Phase II Results</u>

One sediment sample (041M480101) was collected from Wetland 48 and analyzed for TAL metals, pesticides, PCBs, SVOCs, and VOCs in January 1996. The sample location 041M4801 was centrally located within Wetland 48 and adjacent to a culvert along Fuel Farm Road. Wetland-specific and OU-wide evaluations in the RI Report determined that pesticide levels were a potential excess risk. The pesticides, 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'- dichlorodiphenyldichloroethylene (4,4'-DDE) , 4,4'- dichlorodiphenyltrichloroethane (4,4'-DDT), and total DDT (sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT), had concentrations that exceeded the NAS Pensacola basewide sediment values. In addition, Wetland 48 had the highest concentration of total DDT [3,460 micrograms per kilogram (µg/kg)] in the NAS Pensacola wetlands. The Mean ERM quotient evaluation classified the sample as a Category 3.

The total DDT sediment concentration generated a maximum No-Observed-Adverse-Effect Level (NOAEL) hazard quotient (HQ) concentration of 14 during the Food Chain Model evaluation for the piscivorous bird community and a maximum NOAEL HQ concentration of 1.34 for the piscivorous mammal community.

<u>2007 Results</u>

Based on the results of the Phase II investigation and food-chain modeling, Wetland 48 was resampled in 2007 to evaluate the DDT concentration and to delineate the extent of DDT contamination. Of the nine sediment samples collected at Wetland 48, eight exceeded base-wide screening levels for total DDT. The total DDT concentration in the confirmation sample (041M4801) collected at the 1994 location (identified as 041M4801) increased from 3,460 µg/kg to 12,291 µg/kg. Two additional locations (14,400 µg/kg at 041M4802 and 5,400 µg/kg at 041M4809) also exceeded the 1994 maximum detected concentration.

FL-PRO concentrations ranged from 190 mg/kg at 041M4801 to 31,000 mg/kg at 041M4803. The chromatograms and the laboratory standards were reviewed for the FL-PRO results. The laboratory indicated that the results are heavier than their heavy oil standard.

### 1.4.2 Ecological Risk Assessment

All the wetlands in the Remaining Wetlands Group were evaluated collectively to help determine where the highest probabilities of unacceptable risk may occur and whether risk is likely to be related to exposure from IR sites in the area. For the remaining wetlands, the tools that best evaluate risk on an OU-wide basis include:

- **Food-Chain Models (FCMs):** Many of the upper-level predators likely to be present within Site 41 wetlands could be exposed to constituents from more than one wetland. To evaluate this scenario, food-chain models were conducted on an OU-wide basis.

- **Effects Range Mean (ERM) Quotients:** This methodology is an effective way to pinpoint areas of potential excess risk from a mixture of constituents. It is also useful in identifying locations most likely to be impacted by direct toxicity.

- **Basewide Total DDT-Level Comparison:** A base-wide level for total DDT was established at NAS Pensacola. A comparison of site concentrations to the basewide level was presented.

- **TOC-Normalized PAH Concentrations:** PAHs are widespread across NAS Pensacola and have been evaluated based on their potential for adverse effects, when the TOC at each sample location is considered.

- **TOC-Normalized Volatile Organic Compound (VOC) Concentrations:** The article *Technical Basis for Narcotic Chemicals and PAH Criteria. II. Mixtures and Sediments* (Di Toro, J. M. and J. A.

McGrath, 2000b) explains how TOC-normalized VOC concentrations in sediment can be compared to Equilibrium Partitioning Quotient (EqP) Sediment Quality Guideline (SQGs) to develop HQs for evaluation of potential sediment toxicity. Since wetland-specific TOC is available for this site, each Di Toro SQG is normalized based on the amount of organic carbon present at each location (rather than 1% as in the original methodology). At wetlands where TOC is not available for each sample location, the lowest TOC measured in that wetland is used as a conservative surrogate.

#### 1.4.2.1 Assessment Endpoint 1 — Health and Viability of Piscivorous Bird Communities that Forage Throughout Miscellaneous Wetlands

Phase II Evaluation

The only constituent that generated HQs greater than 1 for the piscivorous bird community was total DDT. The total DDT HQs within these wetlands range from 1.4 (max concentration NOAEL HQ) to less than 1 for the average concentration LOAEL HQ, indicating a potential for adverse effects to piscivorous birds. The maximum total DDT concentration in sediment was detected within Wetland 48 (041M4801; 3,460 µg/kg) and was much higher than any other detected concentration. The next highest concentration of total DDT within the remaining wetlands was at Wetland 49 (113 µg/kg).

2007 Wetland 48 Evaluation

The maximum total DDT sediment concentration of 14.4 mg/kg generated a NOAEL HQ concentration of 58.1 to less than 1 for the average concentration LOAEL HQ, indicating a potential for adverse effects to piscivorous birds.

#### 1.4.2.2 Assessment Endpoint 2 — Health and Viability of Piscivorous Mammal Communities that Forage Throughout Miscellaneous Wetlands

Phase II Evaluation

The only constituent generating a HQ greater than 1 for the piscivorous mammal community was total DDT. The total DDT NOAEL HQ calculated using the maximum concentration (from Wetland 48, 041M4801) was 1.34. This HQ greater than 1 indicated the potential for adverse effects to the piscivorous mammal communities that may forage throughout the miscellaneous wetlands. However, based on the HQs, the only location that would generate this potential for adverse effects is the maximum location in Wetland 48.

2007 Evaluation

The maximum total DDT sediment concentration of 14.4 mg/kg generated a maximum NOAEL HQ concentration of 5.56 to less than 1 for the average concentration LOAEL HQ indicating a potential for adverse effects to piscivorous mammal community.

#### 1.4.2.3 Assessment Endpoint 3 — Health and Viability of Predatory Fish Communities that Forage in and around Miscellaneous Wetlands

Phase II

Mercury generated an HQ of 2.4 for the NOAEL HQ calculated using the maximum concentration (0.14 mg/kg), the LOAEL HQ using the maximum concentration, and the NOAEL HQ calculated using the average concentration (0.06 mg/kg). However, the only detection in all of the miscellaneous wetlands was the concentration from the maximum location (041M5701). Therefore, while this location may present a potential for adverse effects, it is unlikely that this limited distribution and low HQs would impact the health and viability of the predatory fish communities that forage within the miscellaneous wetlands.

2007 Wetland 48 Evaluation

This endpoint was not evaluated in 2007.

### 1.4.3 Mean ERM Quotients

Phase II

Of the 13 sediment sample locations, eight locations were within the mean ERM Category 2, and one location was within Category 3. The only location that had any individual ERM exceedances was Wetland 48 sample 041M4801 (only for DDE and DDT). Using this methodology, most of the wetlands incorporated within the miscellaneous wetlands have high uncertainty and require additional lines of evidence for evaluation. However, based on the mean ERM quotient methodology, it is likely that some level of direct toxicity may be present within Wetland 48.

2007 Wetland 48 Results

This technique was not applied to the data collected in 2007.

### 1.4.4 Basewide Total DDT-Levels

Phase II

Two locations in the miscellaneous wetlands exceeded the basewide levels. The largest concentration was in Wetland 48 at sample location 041M4801 (3,460 µg/kg) and the other exceedance was in Wetland 49 with a concentration of 113.2 µg/kg.

2007 Wetland 48 Results

Of the nine samples collected at Wetland 48, eight exceeded base-wide screening levels (110 µg/kg) for total DDT. The total DDT concentration in the confirmation sample (041M4801) collected at the 1994 location (identified as 041M4801) increased from 3,460 µg/kg to 12,291 µg/kg. Two additional locations (14,400 µg/kg at 041M4802 and 5,400 µg/kg at 041M4809) also exceeded the 1994 maximum detected concentration.

### 1.4.5 TOC-Normalized Total PAHs Concentrations

No detected TOC–normalized PAHs within the miscellaneous wetlands exceeded the Swartz TEC; therefore, they are not likely to pose any unacceptable levels of risk related to exposure to PAHs.

2007 Wetland 48 Results

This technique was not applied to the data collected in 2007.

### 1.4.6 Conclusions

Using the lines of evidence presented in the ecological risk assessment, the area of primary concern is DDT in Wetland 48. Update of DDT in piscivorous birds and mammals are evaluated in this FS. The FL-PRO results will be evaluated during the Pre-Design phase.

## 1.5 NATURE AND EXTENT OF CONTAMINATION

An RI was completed at the NAS Pensacola Site 41 wetlands in three phases: (1) Phase I was performed during August 1994; (2) Phase II (formerly called IIA) was performed from November 1995 through January 1996; (3) Phase III (formerly called IIB/III) was performed during August and September 1997. The RI conducted by EnSafe, Inc. included an evaluation of the nature and extent of contamination in surface water and sediment, an analysis of contaminant fate and transport, and human health and ecological risk assessments. The results of the RI were reported by EnSafe in 2007. The RI did not identify COCs; however, COPCs were identified in the RI, and these COPCs are identified in the following sections. In Section 2.0 of this FS, the COPCs identified in the RI are further evaluated and the retained COCs are listed.

### 1.5.1 Wetland 3

During the investigation, a total of eight surface water and 12 sediment samples were collected at Wetland 3.

The child trespasser and adult maintenance worker scenarios were assessed for this wetland in the RI. The following COPCs were identified in the RI Human Health Risk Assessment (HHRA) for Wetland 3:

- Arsenic (adult maintenance worker dermal contact and ingestion, sediment)
- Methylene chloride (adult maintenance worker dermal contact and ingestion, sediment)

Sediment COPCs retained in the RI based on ecological risk include the following: aluminum, barium, cadmium, chromium, iron, manganese, selenium, vanadium, zinc, aldrin, dieldrin, endosulfan sulfate, total chlordane, endrin, endrin ketone, carbon disulfide, alpha-BHC, total BHC, 4,4'-DDD, 4,4'-DDT, total DDT, Aroclor-1260, total PCBs, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and phenol.

Surface water COPCs retained in the RI based on ecological risk include the following: aluminum, iron, lead, manganese, barium, cadmium, copper, vanadium, Aroclor-1260, endrin ketone, total endrin, acetone, total PCBs, total PAHs, 1,4-dichlorobenzene, chlorobenzene, and cis-1,2-dichloroethene.

Figure 1-6 provides Wetland 3 sediment and surface water sample locations.

### 1.5.2 Wetland 15

During the investigation, a total of two surface water and four sediment samples were collected at Wetland 15.

The child trespasser, adult maintenance worker, and fisherman scenarios were assessed in the RI for this wetland. The following COPCs were identified in the HHRA for Wetland 15:

- Arsenic (trespasser and worker dermal contact and ingestion, sediment and surface water)
- 4,4'-DDD (fisherman - fish tissue uptake from sediment)
- 4,4'-DDE (fisherman - fish tissue uptake from sediment)
- Aroclor-1260 (fisherman - fish tissue uptake from sediment)
- delta-BHC (fisherman - fish tissue uptake from sediment)

Sediment COPCs retained in the RI based on ecological risk include the following: aluminum, arsenic, barium, beryllium, cobalt, iron, lead, manganese, selenium, vanadium, endosulfan I, heptachlor, endrin, endrin aldehyde, endrin ketone, total endrin, beta-BHC, delta-BHC, total BHC, 4,4'-DDD, total DDT, 2,2'-oxybis(1-chloropropane)/bis(2-chlor), 2,4-dimethylphenol, 2-methylphenol (o-Cresol), 4-methylphenol (p-Cresol), and phenol.

Surface water COPCs retained in the RI based on ecological risk include the following: aluminum, antimony, arsenic, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, zinc, 4,4'-DDE, and total DDT.

Figure 1-7 provides Wetland 15 sediment and surface water sample locations.

### 1.5.3 Wetland 16

During the investigation, a total of four surface water and five sediment samples were collected at Wetland 16.

The child trespasser, adult maintenance worker, and fisherman scenarios were assessed in the RI for this wetland. Human health risk associated with Phase II Aroclor-1254 concentrations in sediment exceeded FDEP's risk threshold of 1 x $10^{-6}$ of fish tissue uptake. However, risk assessment using Phase III sediment sample data and Phase IV surface water sample data did not identify any human health risks associated with sediment or surface water at Wetland 16.

Sediment COPCs retained in the RI based on ecological risk include the following: aluminum, barium, beryllium, cadmium, cobalt, iron, lead, manganese, selenium, silver, vanadium, zinc, and total endrin.

Surface water COPCs retained in the RI based on ecological risk include the following: antimony, manganese, iron, thallium, barium, and 1,1-dichloroethane.

Figure 1-8 provides Wetland 16 sediment and surface water sample locations.

### 1.5.4 Wetland 18A

During the investigation, a total of two surface water and four sediment samples were collected at Wetland 18A.

The child trespasser and adult maintenance worker scenarios were assessed for this wetland in the RI. The following COPCs were identified in the HHRA for Wetland 18A:

- Arsenic (child trespasser and adult maintenance worker, sediment ingestion and dermal contact)
- Arsenic (child trespasser and adult maintenance worker, surface water dermal contact)

Sediment COPCs retained in the RI based on ecological risk include the following: barium, iron, manganese, selenium, aldrin, alpha-chlordane, gamma-chlordane, total chlordane, endrin, endrin ketone, total endrin, beta-BHC, total BHC, 4,4'-DDD, 4,4'-DDT, total DDT, 1,4-dichlorobenzene, 4-methylphenol (p-Cresol).

Surface water COPCs retained in the RI based on ecological risk include the following: aluminum, arsenic, iron, lead, manganese, barium, chromium, vanadium.

Figure 1-9 provides Wetland 18A sediment and surface water sample locations.

### 1.5.5 Wetland 18B

During the investigation, a total of one surface water and two sediment samples were collected at Wetland 18B.

The child trespasser and adult maintenance worker scenarios were assessed for this wetland in the RI. The following COPC was identified in the HHRA for Wetland 18B:

- Arsenic (child trespasser and adult maintenance worker, sediment ingestion and dermal contact)

Sediment COPCs retained in the RI based on ecological risk include the following: aluminum, arsenic, barium, beryllium, cyanide, iron, manganese, selenium, vanadium, 4,4'-DDD, 4,4'-DDT, and total DDT.

Surface water COPCs retained in the RI based on ecological risk include the following: iron, manganese, selenium, 4,4'-DDT, and total DDT.

Figure 1-10 provides Wetland 18B sediment and surface water sample locations.

### 1.5.6 Wetland 5A

During the investigation, a total of nine surface water and ten sediment samples were collected at Wetland 5A.

The child trespasser and adult maintenance worker scenarios were assessed for this wetland in the RI. No COPCs were identified based on human health risk for Wetland 5A.

Sediment COPCs retained in the RI based on ecological risk include the following: antimony, aluminum, barium, cadmium, cobalt, copper, lead, manganese, mercury, zinc, endosulfan I, endosulfan II, endosulfan sulfate, total endrin, total BHC, total DDT, 4-methylphenol (p-Cresol), benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-chloroethoxy)methane, carbazole, and indeno(1,2,3-cd)pyrene, gamma-chlordane, total chlordane, 4,4'-DDD, 4,4'-DDT, and total DDT.

Surface water COPCs retained in the RI based on ecological risk include the following: lead, manganese, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, vanadium, zinc, bis(2-Ethylhexyl) phthalate (BEHP), dibromochloromethane, acetone, cis-1,2-dichloroethene, acetone, bromodichloromethane, and 1,1-dichloroethane.

Figure 1-11 provides Wetland 5A sediment and surface water sample locations.

### 1.5.7 Wetland 48

During the investigation, one surface water and 10 sediment samples were collected at Wetland 48.

The child trespasser and adult maintenance worker scenarios were assessed for this wetland in the RI. No COPCs were identified based on human health risks for Wetland 48.

Sediment COPCs retained in the RI based on ecological risk include the following: 4-4'-DDD, 4,4'-DDE, 4,4'-DDT, and total DDT.

No surface water COPCs were retained in the RI based on ecological risk.

Figure 1-12 provides Wetland 48 sediment and surface water sample locations.

### 1.5.8 Wetland 64

During the investigation, a total of two surface water and 34 sediment samples were collected at Wetland 64.

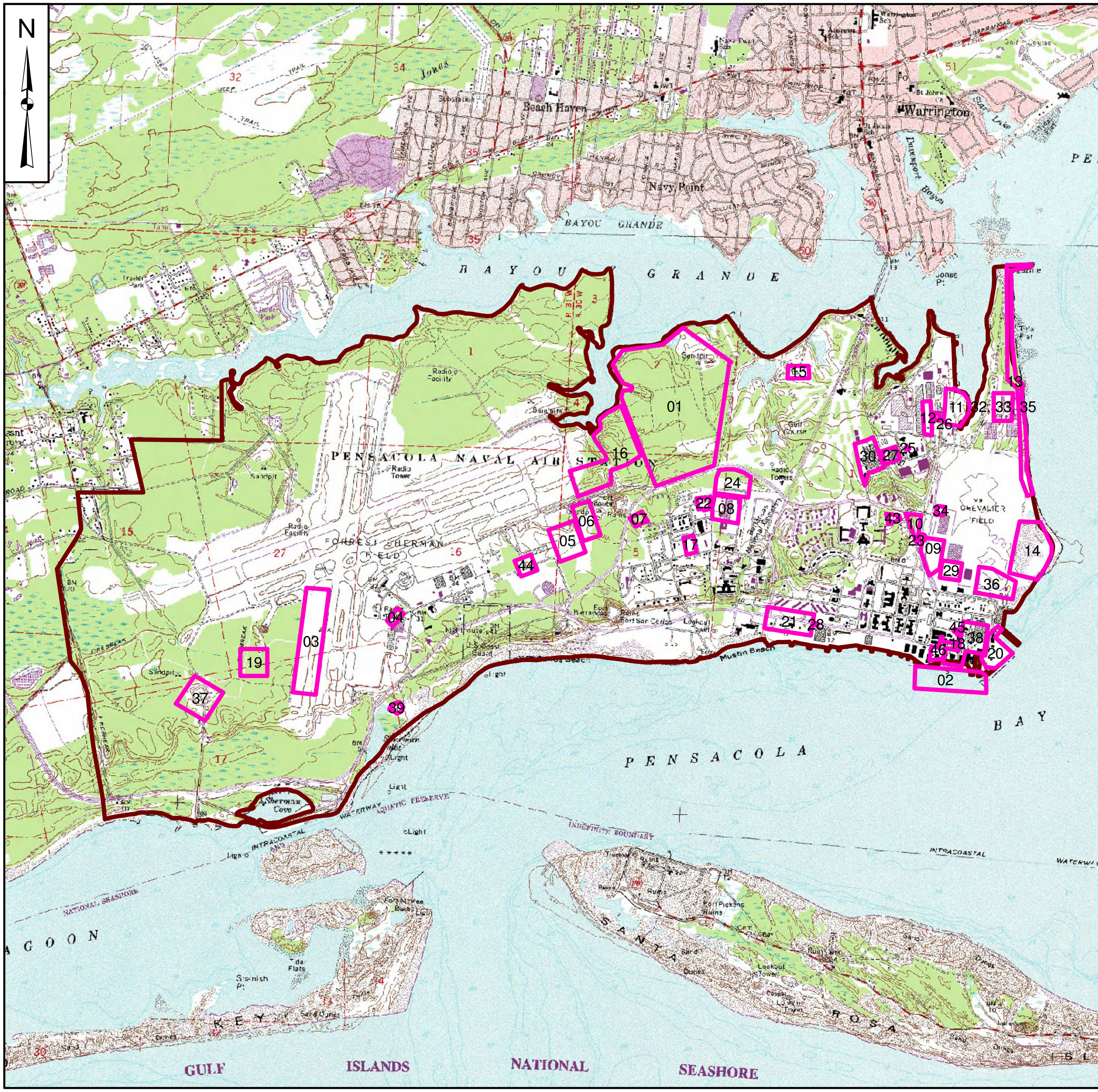
The child trespasser and adult maintenance worker scenarios for surface water and the recreational and subsistence fishermen scenarios for game fish tissue ingestion were assessed for this wetland in the RI. The following COPCs were identified in the HHRA for Wetland 64:

- 4-4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, delta-BHC, alpha-chlordane, Aroclor-1254, Aroclor-1260, gamma-chlordane, and BEHP (game fish tissue ingestion, sediment)

Sediment COPCs retained in the RI based on ecological risk include the following: aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium, zinc, heptachlor epoxide, aldrin, dieldrin, endosulfan I, endosulfan II, heptachlor, alpha-chlordane, gamma-chlordane, total chlordane, endrin, endrin aldehyde, total endrin, delta-BHC, gamma-BHC (Lindane), total BHC, 4,4'-DDD, total DDT, Aroclor-1254, Aroclor-1260, total PCBs, BEHP, 1,2-dichlorobenzene, 1,4-dichlorobenzene, carbazole, dibenzofuran, phenol, and carbon disulfide.

No surface water COPCs were retained in the RI based on ecological risk.

Figure 1-13 provides Wetland 64 sediment and surface water sample locations.




NAVFAC
Naval Facilities Engineering Command

**Figure 1-1**
**Site Location Map**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

Site Boundary
Installation Boundary

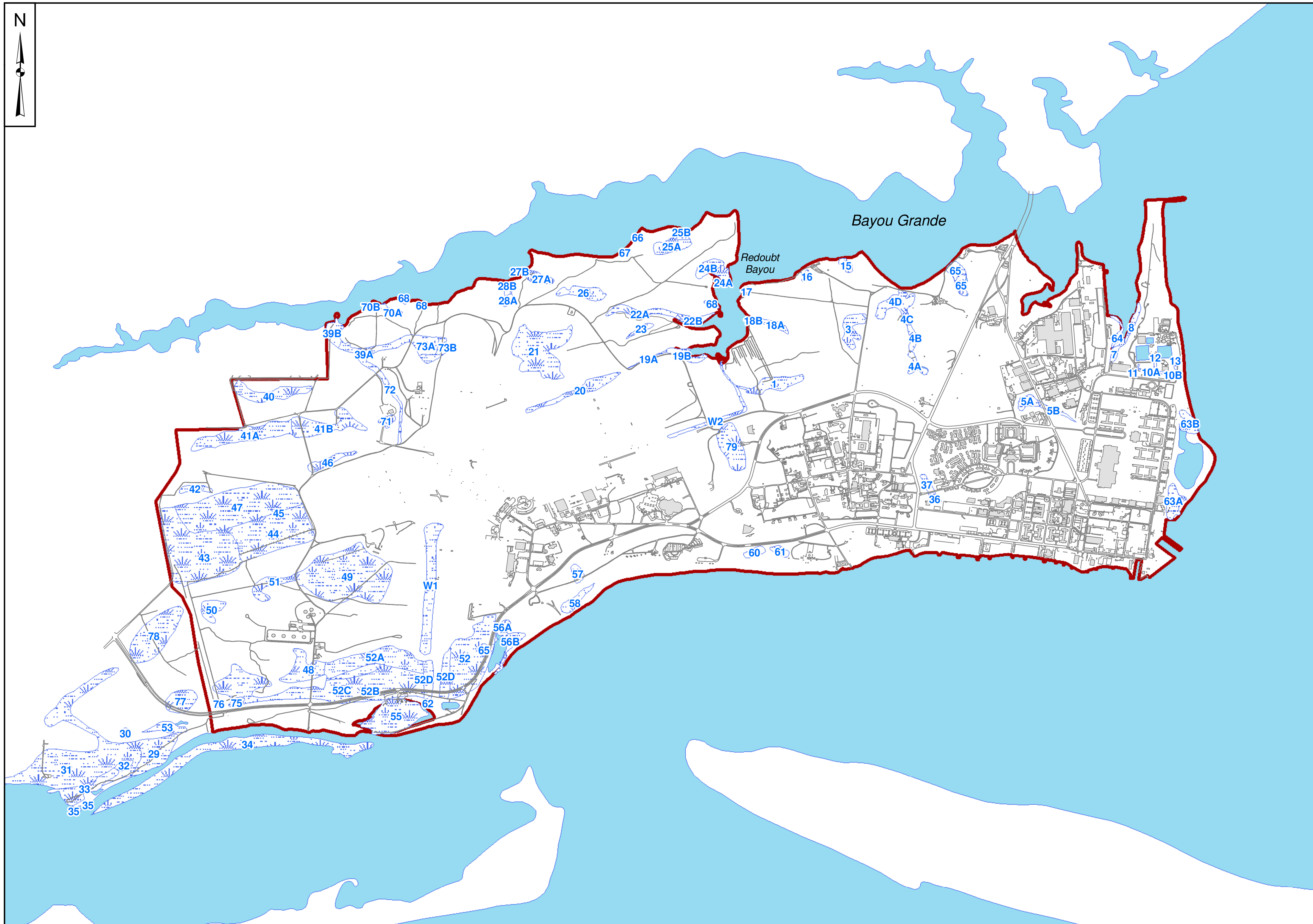
4,000 2,000 0 4,000
Feet

TETRA TECH

Drawn By: K. MOORE 11/26/08
Checked By: N. ROCHNA 12/10/08
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
TOPO_SITE_LOCATION.MXD 12/10/08 KM




NAVFAC Naval Facilities Engineering Command

**Figure 1-2**
**NAS Pensacola Wetlands**
**and Associated Sites**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

- Road
- Building
- Wetland
- Installation Boundary
- Water

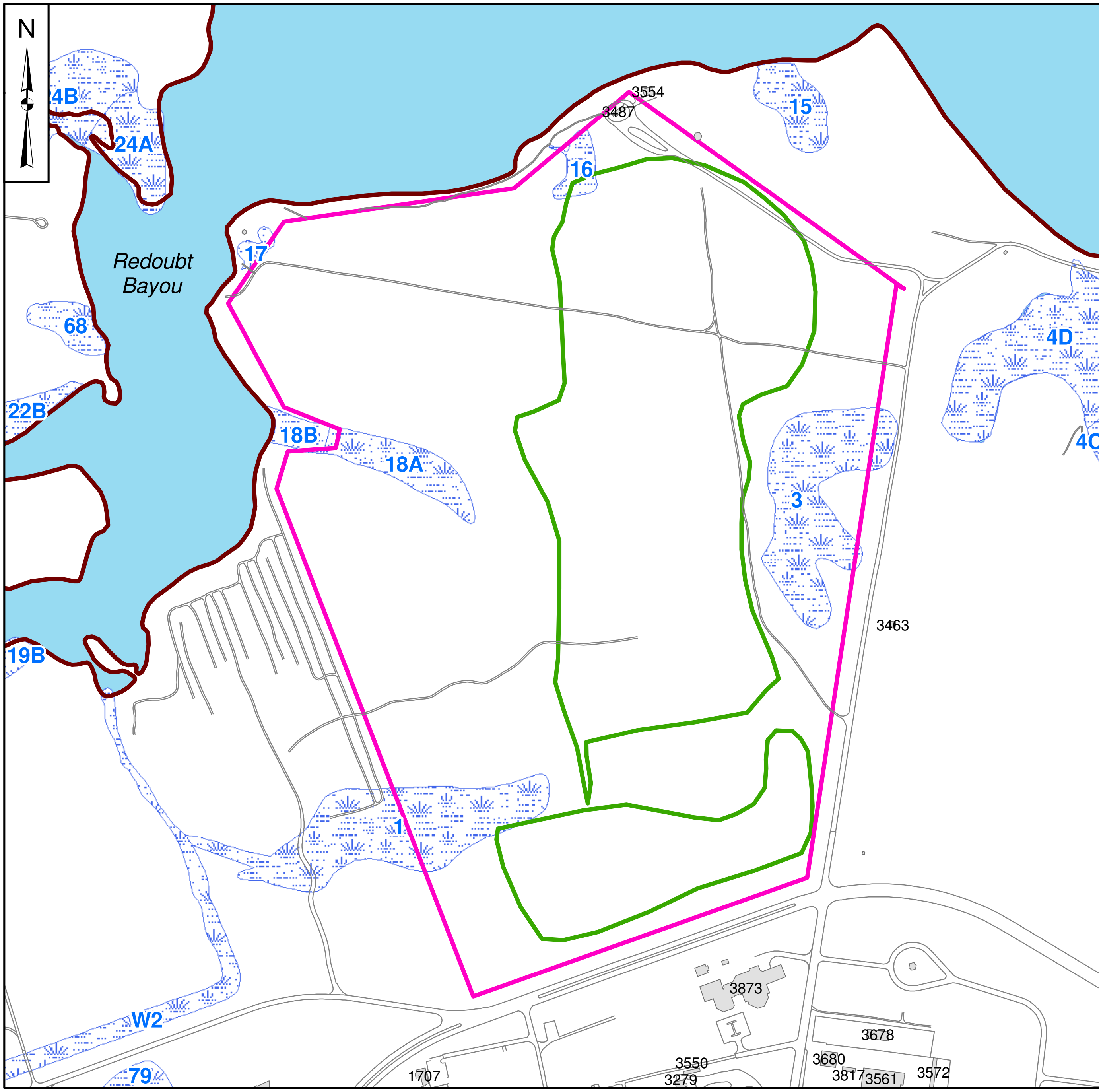
3,000 1,500 0 3,000 Feet

TETRA TECH

Drawn By: K. MOORE 11/26/08
Checked By: N. ROCHNA 1/8/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS_LOCATION.MXD 1/8/09 KM




Naval Facilities Engineering Command

**Figure 1-3**
**Site Location Map**
**Wetlands 3, 15, 16, 18A, and 18B**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

- Building
- Road
- Site 1 Boundary
- Landfill Boundary
- Installation Boundary
- Water

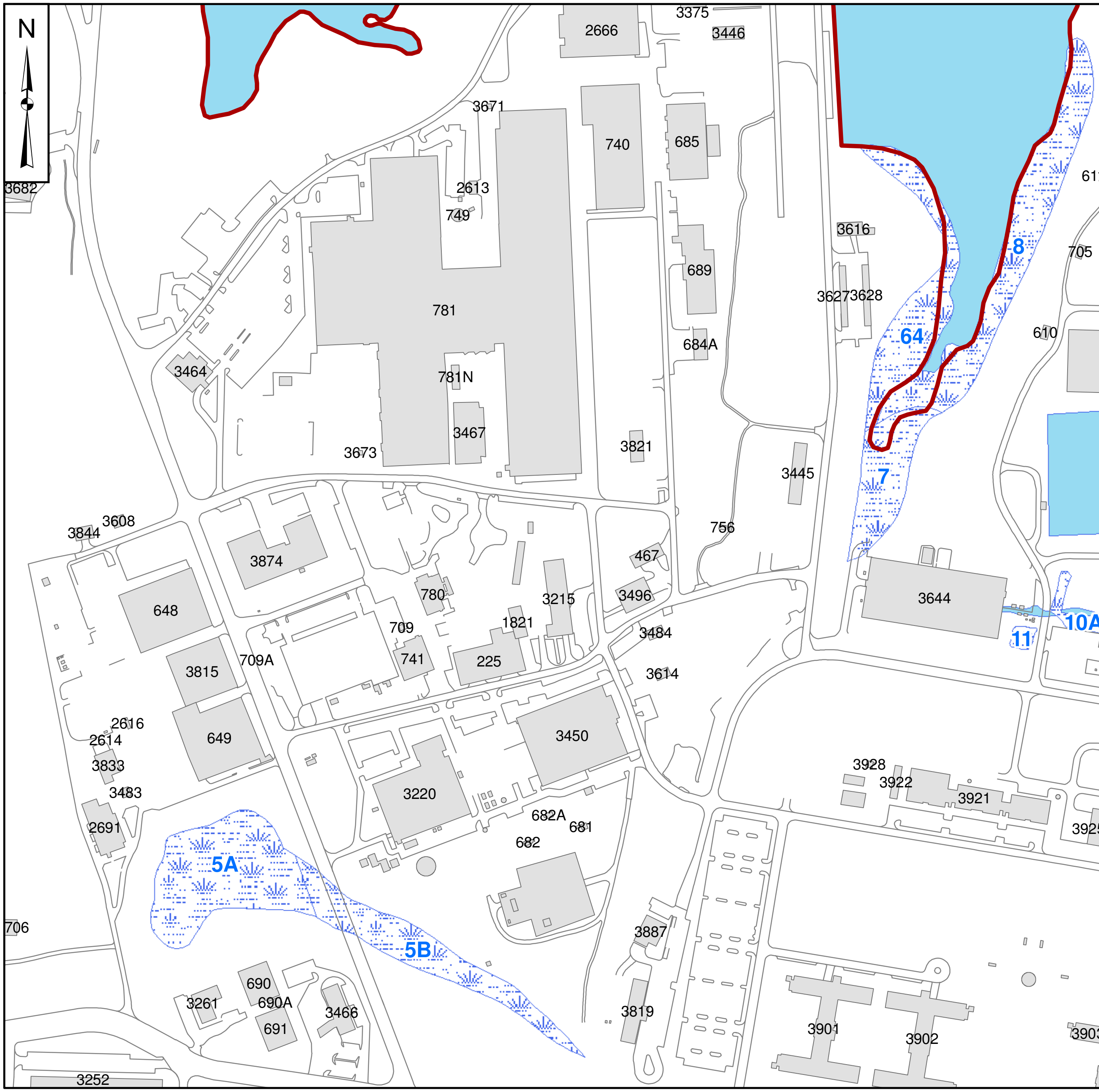
700 350 0 700 Feet

TETRA TECH

Drawn By: K. MOORE 11/26/08
Checked By: N. ROCHNA 1/8/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
SITE01_WETLANDS_LOCATION.MXD 1/8/09 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-4**
**Site Location Map**
**Wetland 5A and 64**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

- Building
- Road
- Installation Boundary
- Wetland
- Water

500 250 0 500
Feet

TETRA TECH

Drawn By: K. MOORE 11/26/08
Checked By: N. ROCHNA 12/10/08
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLAND64-5A_LOCATION.MXD 12/10/08 KM

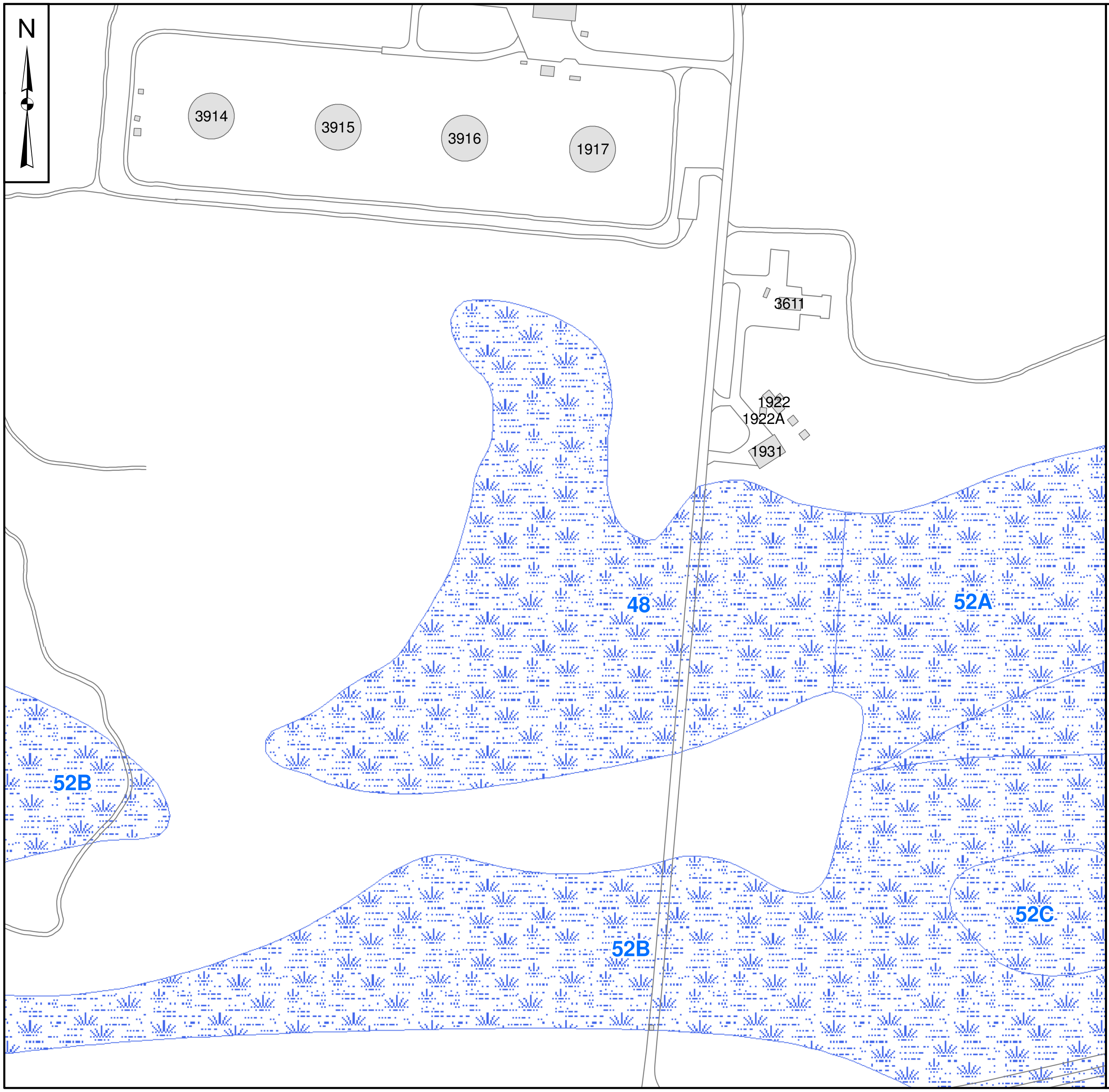



**Figure 1-5**
**Site Location Map**
**Wetland 48**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

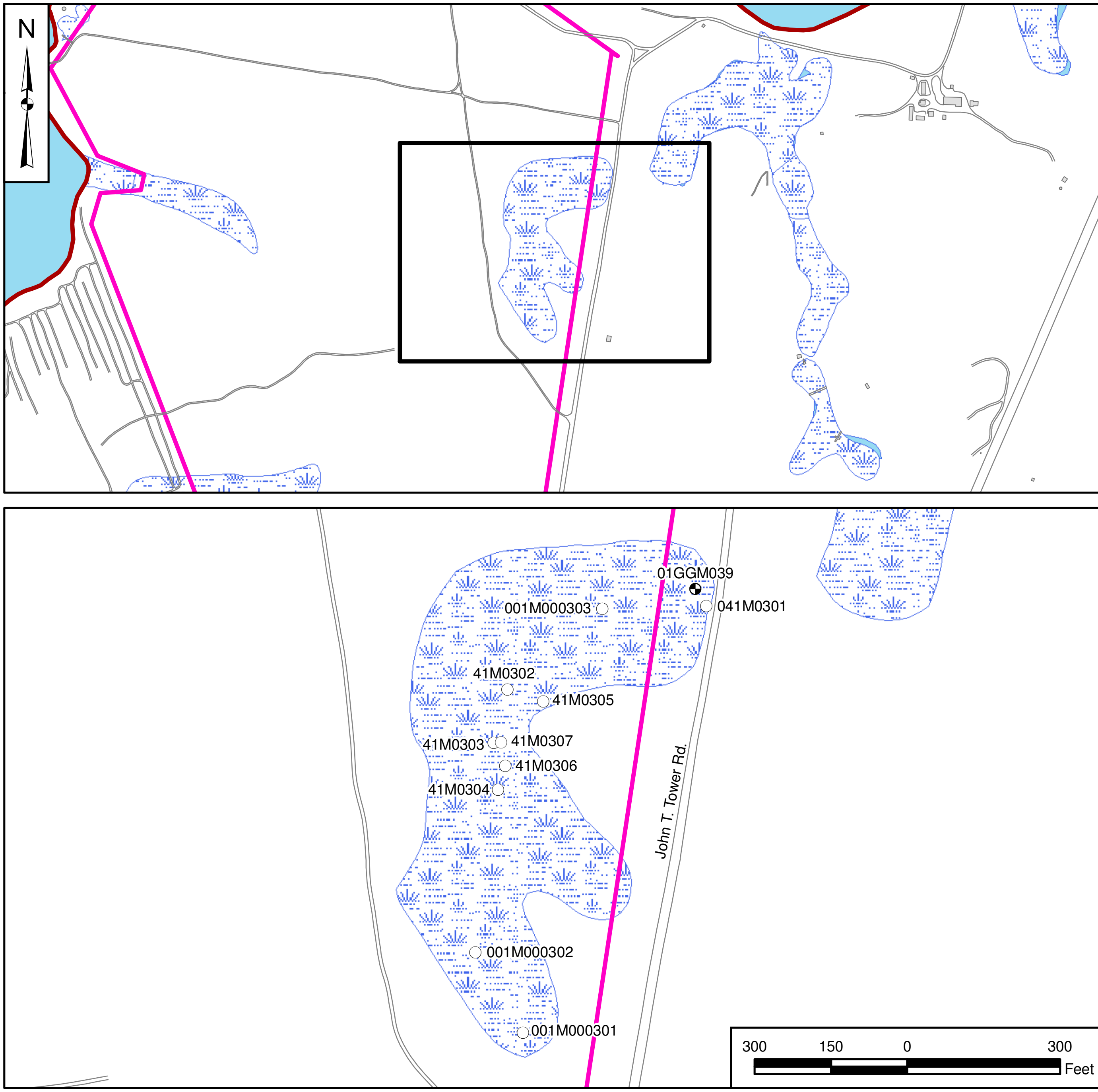
- Building
- Road
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 11/26/08
Checked By: N. ROCHNA 12/10/08
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLAND48_LOCATION.MXD 12/10/08 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-6**
**Wetland 3 Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

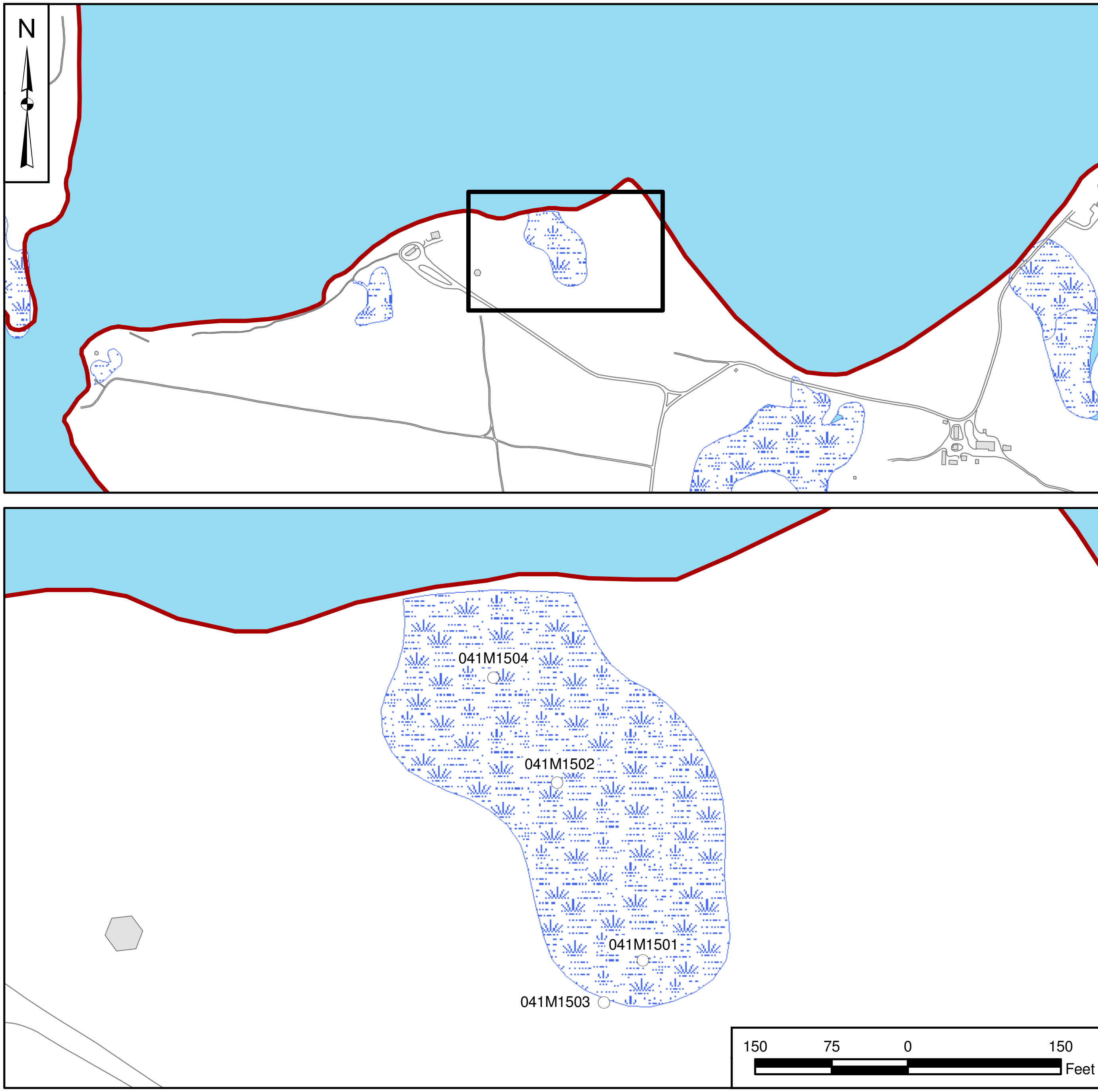
- Groundwater Sampling Location
- Sediment Sampling Location
- Road
- Site 1 Boundary
- Installation Boundary
- Wetland

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS03_SAMPLES.MXD 3/17/09 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-7**
**Wetland 15 Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

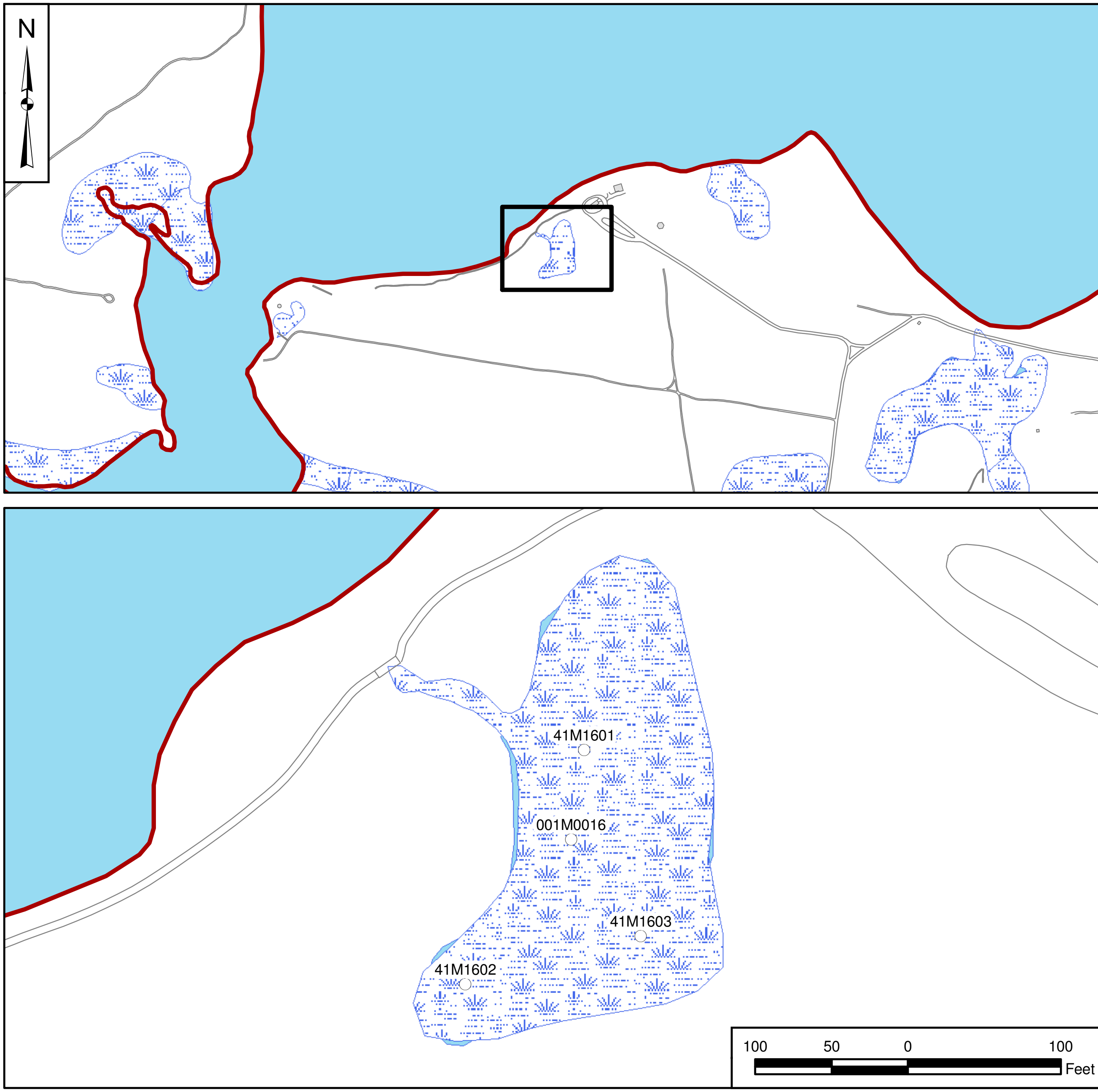
- Sediment Sample Location
- Building
- Road
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS15_SAMPLES.MXD 3/17/09 KM




Naval Facilities Engineering Command

**Figure 1-8**
**Wetland 16 Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

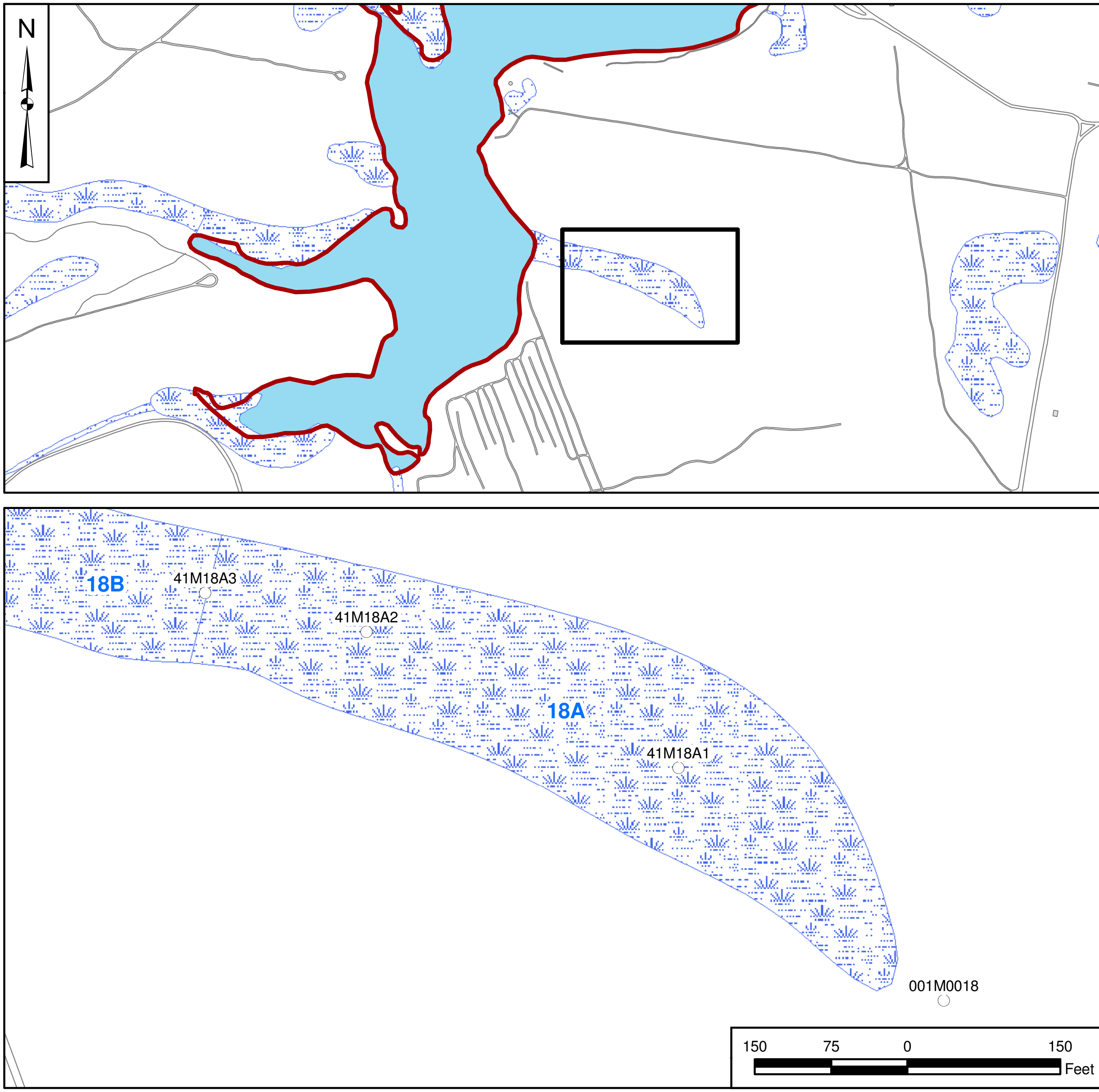
- Sediment Sampling Location
- Road
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS16_SAMPLES.MXD 3/17/09 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-9**
**Wetland 18A Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

- Sediment Sampling Location
- Road
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS18A_SAMPLES.MXD 3/17/09 KM

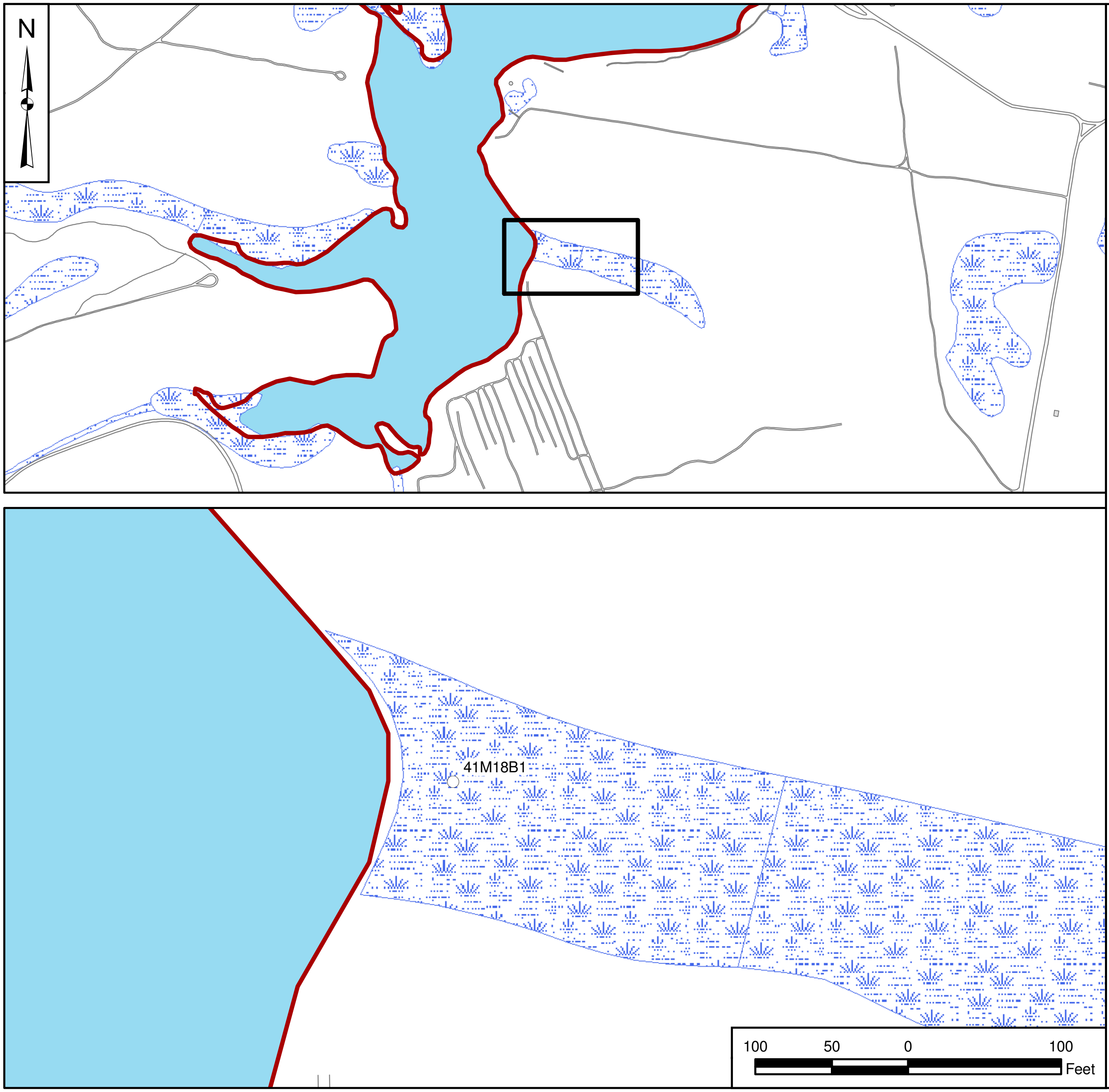



**Figure 1-10**
**Wetland 18B Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

NAVFAC Naval Facilities Engineering Command

## Legend

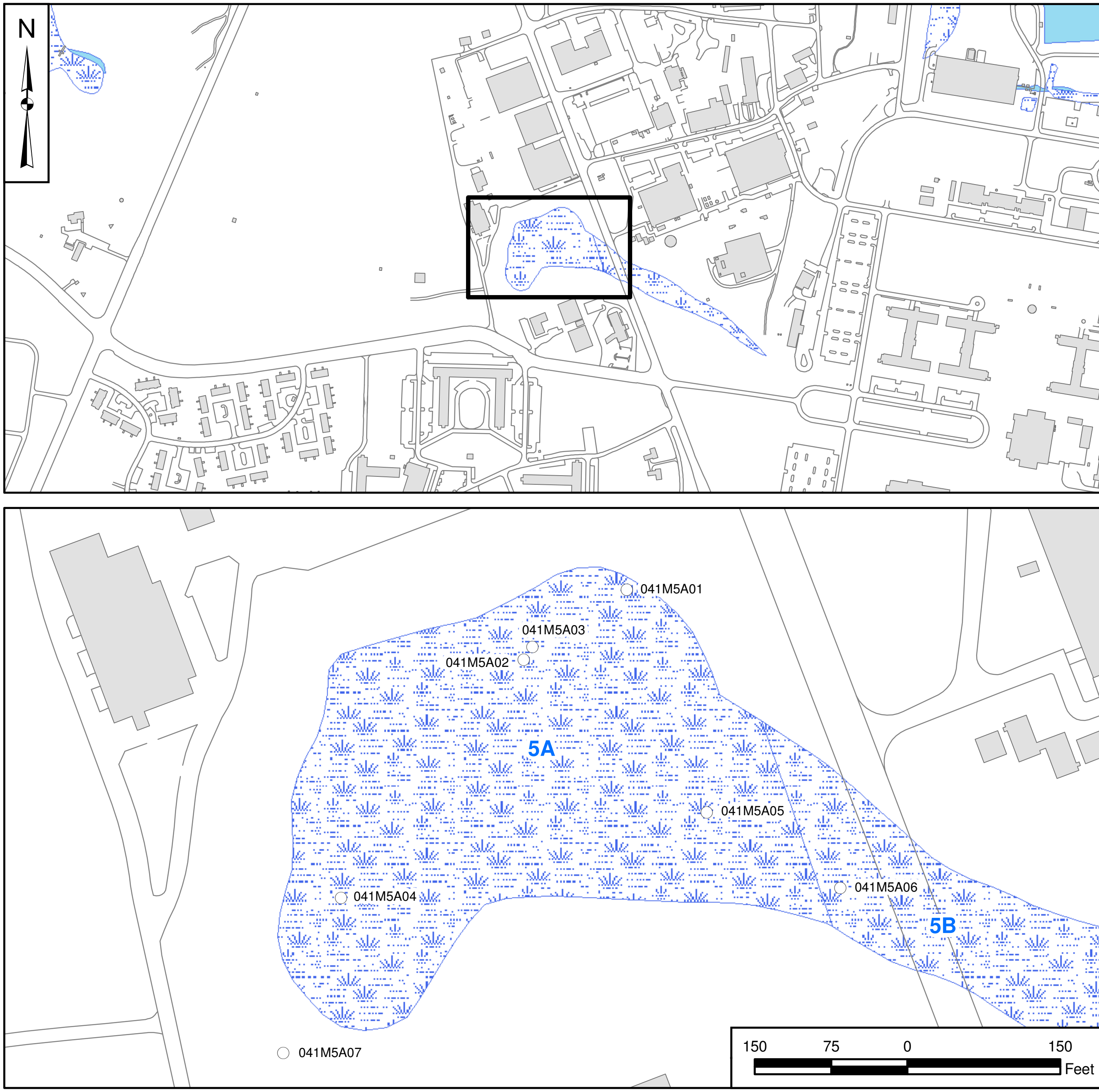
- Sediment Sampling Location
- Road
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS18B_SAMPLES.MXD 3/17/09 KM




Naval Facilities Engineering Command

**Figure 1-11**
**Wetland 5A Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

**Legend**

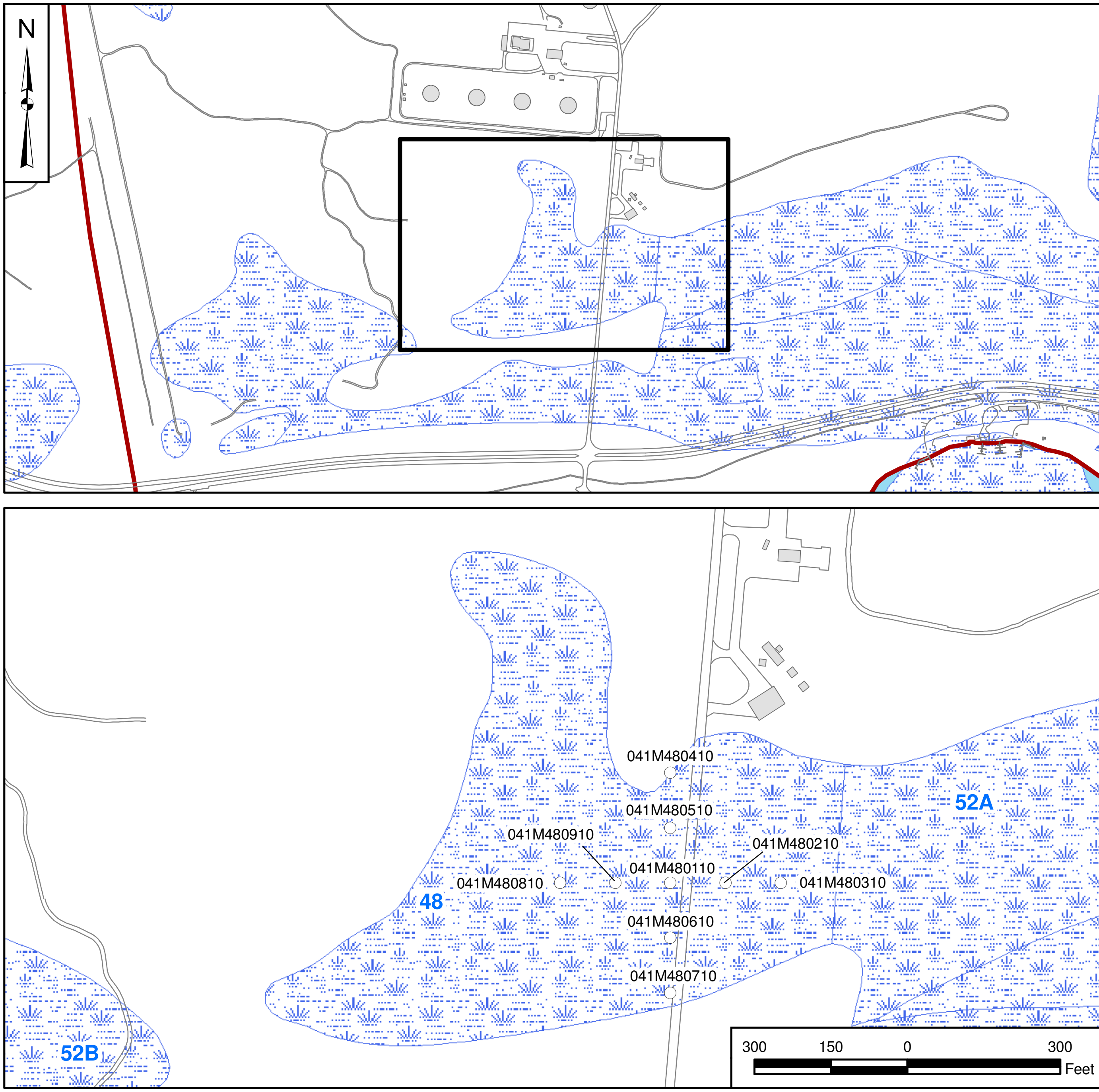
- Sediment Sampling Location
- Road
- Building
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 3/17/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS05_SAMPLES.MXD 3/17/09 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-12**
**Wetland 48 Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

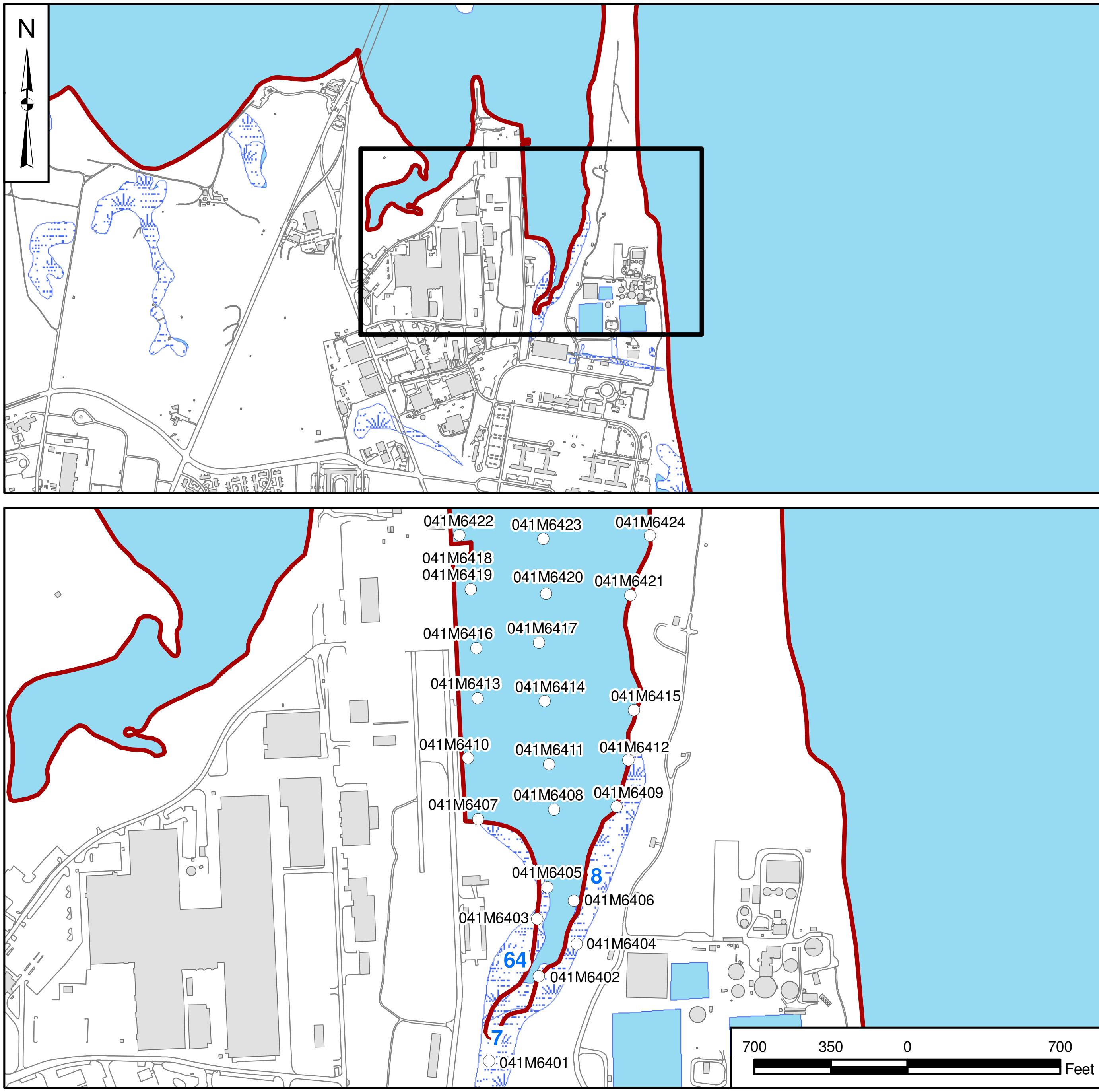
- Sediment Sampling Location
- Building
- Road
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 12/10/08
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS48_SAMPLES.MXD 12/10/08 KM




NAVFAC
Naval Facilities Engineering Command

**Figure 1-13**
**Wetland 64 Sampling Locations**
**Site 41 Feasibility Study Report**
**NAS Pensacola**
**Pensacola, Florida**

## Legend

- Sediment Sampling Location
- Road
- Building
- Installation Boundary
- Wetland
- Water

TETRA TECH

Drawn By: K. MOORE 9/29/08
Checked By: N. ROCHNA 12/10/08
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\MXD\
WETLANDS64_SAMPLES.MXD 12/10/08 KM

# 2.0 REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

This section identifies the medium of concern, develops RAOs, and derives PRGs for the contaminated medium. The regulatory requirements and guidance that may potentially govern remedial activities are also presented in this section. In addition, this section presents GRAs that may be suitable to achieve the PRGs. Finally, this section presents estimates of the volumes of contaminated medium.

## 2.1 REMEDIAL ACTION OBJECTIVES

Development of RAOs is an important step in the FS process. The RAOs are medium-specific goals that define the objectives of conducting remedial actions to protect human health and the environment.

RAOs for the medium of concern at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64 (sediment) are defined below. In addition to these RAOs, remedial actions must also have minimal impact on the Navy's ability to perform its mission at NAS Pensacola.

### 2.1.1 Statement of Remedial Action Objectives

Site-specific RAOs specify COCs, medium of interest, exposure pathways, and cleanup goals or acceptable contaminant concentrations. This FS addresses sediment contamination at Site 41. The RAOs were developed to permit consideration of institutional controls, monitoring, and containment alternatives based on current and potential future land use. To protect the public from current and potential future health risks, as well as to protect the environment, the following RAOs were developed for Site 41:

- Prevent unacceptable human health risk associated with COCs at concentrations greater than established PRGs in sediment at Wetlands 3, 15, 16, 18A, 18B, 48, and 64.

- Reduce, to the extent practicable, unacceptable risk to aquatic receptors exposed to COCs at concentrations greater than established PRGs in sediment at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64.

### 2.1.2 Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

ARARs consist of the following:

- Any standard, requirement, criterion, or limitation under federal environmental law.
- Any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated federal standard, requirement, criterion, or limitation.

TBCs are non-promulgated, non-enforceable guidelines or criteria that may be useful for developing a remedial action or are necessary for determining what is protective of human health and/or the environment. Examples of TBCs include USEPA Drinking Water Health Advisories, Reference Doses (RfDs), and Cancer Slope Factors (CSFs).

One of the primary concerns during the development of remedial action alternatives for hazardous waste sites under CERCLA is the degree of human health and environmental protection offered by a given remedy. Section 121 of CERCLA requires that primary consideration be given to remedial alternatives that attain or exceed ARARs. The purpose of this requirement is to ensure that CERCLA response actions are consistent with other pertinent federal and state environmental requirements.

#### 2.1.2.1 Definitions

The definitions of ARARs and TBCs are as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

- Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, that although not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

- TBCs are a category created by the USEPA that includes non-promulgated criteria, advisories, and guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. However, pertinent TBCs were considered along with ARARs in determining the necessary level of cleanup or technology requirements.

Under CERCLA Section 121(d)(4), USEPA may waive compliance with an ARAR if one of the following conditions can be demonstrated:

- The remedial action selected is only part of a total remedial action that will attain the ARAR level or standard of control upon completion.
- Compliance with the requirement will result in greater risk to human health and the environment than other alternatives.
- Compliance with the requirement is technically impracticable from an engineering perspective.
- The remedial action selected will attain a standard of performance that is equivalent to that required by the ARAR through the use of another method or approach.
- With respect to a state requirement, the state has not consistently applied the ARAR in similar circumstances at other remedial actions within the state.
- Compliance with the ARAR will not provide a balance between protecting public health, welfare, and the environment at the facility and the availability of Superfund money for response at other facilities (fund-balancing). This condition only applies to Superfund-financed actions.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) identifies three categories of ARARs [40 Code of Federal Regulations (CFR) Section 300.400 (g)]:

- <u>Chemical-Specific</u>: Health risk-based numerical values or methodologies that establish concentration or discharge limits for particular contaminants. Examples include the Clean Water Act (CWA) Ambient Water Quality Criteria (AWQCs).
- <u>Location-Specific</u>: Restrictions on actions or contaminant concentrations in certain environmentally sensitive areas. Examples of these areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present.
- <u>Action-Specific</u>: Technology- or activity-based requirements, limitations on actions, or conditions involving special substances. Examples of action-specific ARARs include wastewater discharge standards.

The following section discusses chemical-, location-, and action-specific ARARs and TBCs for remedial actions that may be taken at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64 and for the types of technologies that will be developed into remedial alternatives.

#### 2.1.2.2 Chemical-Specific ARARs and TBCs

Federal and state chemical-specific ARARs and TBCs provide some medium-specific guidance on "acceptable" or "permissible" concentrations of contaminants. Tables 2-1 and 2-2 present lists of federal and State of Florida chemical-specific ARARs and TBCs, respectively, for this FS.

#### 2.1.2.3 Location-Specific ARARs and TBCs

Federal and state location-specific ARARs and TBCs place restrictions on concentrations of contaminants or the conduct of activities based on the particular characteristics or location of a site. Tables 2-3 and 2-4 present lists of federal and State of Florida location-specific ARARs and TBCs, respectively, for this FS.

#### 2.1.2.4 Action-Specific ARARs and TBCs

Federal and state action-specific ARARs and TBCs are technology- or activity-based regulatory requirements or guidance that would control or restrict remedial action. Tables 2-5 and 2-6 present lists of federal and State of Florida action-specific ARARs and TBCs, respectively, for this FS.

### 2.1.3 <u>Medium of Concern</u>

The nature and extent of sediment contamination at Site 41 in Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64 has been defined and is summarized in Section 1.0. The investigation of the wetlands consisted of evaluating potential human health and ecological risks from chemicals in sediment and surface water. Based on the results of the risk assessments for human and ecological receptors, the media of concern are sediment and surface water. Surface water contamination is expected to be caused by the leaching of sediment contaminants. Due to surface water conditions continually changing overtime it was not evaluated in this FS.

### 2.1.4 <u>Chemicals of Concern</u>

After comparison to refinement values, COPCs were further evaluated using the following lines of evidence to identify the primary risk drivers:

- Basewide evaluation for DDT and breakdown products to provide a point of reference for determining impacts from general pesticide application

- Food chain models review for toxicity as it might travel from sediment to predator species such as green heron and mink

- TOC normalization as a method for using carbon content of sediment to assess the availability of PAHs and VOCs to ecological receptors

- Regression analysis of metals concentrations to evaluate whether metals are naturally-occurring

- Mean ERM quotients to represent the likelihood of adverse effects due to direct toxicity

- Selective toxicity testing after extrapolating results from representative wetlands

- The analyses and results are presented in Sections 10 through 15 of the RI Report. Select pesticides (DDT, endrin, chlordane, BHC, PCBs, dieldrin) were evaluated using multiple food chain models. DDT and its breakdown products were also compared to base-wide levels. Excess risk from pesticides at OU 1 and OU 2 was not indicated by the food chain model results. Therefore, those pesticides evaluated using the food chain models were not retained as risk drivers. DDT, DDD and DDE are retained as risk drivers for Wetland 48 based on the food chain model results.

- Conversely, mercury was also evaluated using a food chain model. Although mercury concentrations in sediment were below its refinement value at OU 2, mercury was calculated to show an excess risk to predatory fish. Therefore, mercury was retained as a risk driver at Wetland 64, the only wetland at OU 2 that has habitat to support predatory fish.

- VOCs and PAHs were eliminated as risk drivers based on the results of the TOC normalization analysis.

Based on the large disparity of sediment chemistry results for Wetlands 15, 16, and 18 between Phase II and III, metals COPCs were generally retained for Wetlands 15, 16, and 18 as risk drivers even though Phase III toxicity test results at Wetlands 16 and 18 did not indicate direct toxicity.

Finally, endosulfan I and endosulfan sulfate were detected in the low part per billion range, and are not considered primary risk drivers. Endosulfan I and endosulfan sulfate are collocated with metals concentrations indicating excess risk and would be addressed with those identified risk drivers.

Sediment COCs were determined based on the results of human health risk assessment, refined ecological risk assessment (refinement value), and toxicity testing results. In addition, NAS Pensacola reference concentrations were available for many of the sediment COCs, allowing direct comparisons to base-wide background concentrations. Sediment results from all investigative phases of sampling were evaluated. Prior to implementation of selected remedial alternatives, additional sediment samples should be collected from each wetland to determine current sediment quality.

#### 2.1.4.1 Wetland 3

Although methylene chloride was listed as a COPC, this analyte was not detected in any sample. It is therefore not retained as a COC. The following COCs in sediment were retained for in Wetland 3:

| | |
|---|---|
| Human health COCs: | Arsenic |
| Ecological COCs: | Cadmium, iron, and endosulfan sulfate. |

#### 2.1.4.2 Wetland 5A

No human health COCs were retained for sediment at Wetland 5A. Ecological COCs in sediment are as follows:

| | |
|---|---|
| Ecological COCs: | Copper, lead, and zinc. |

Endosulfan I was retained as an ecological COC in the RI but was eliminated based on comparison to the NOEC, value determined through available toxicity data.

#### 2.1.4.3 Wetland 15

The following COCs in sediment were retained at Wetland 15:

| | |
|---|---|
| Human health: | Arsenic, 4,4’-DDD, 4,4’-DDE, Aroclor-1260, and delta-BHC. |
| Ecological: | Aluminum, arsenic, barium, beryllium, iron, manganese, selenium, vanadium, endosulfan I, heptachlor, 2,2'-oxybis(1-Chloropropane)/ bis(2-chlor, 2,4-dimethylphenol, 2-methylphenol (o-cresol), 4-methylphenol (p-cresol), and phenol. |

#### 2.1.4.4 Wetland 16

The following COCs in sediment were retained for Wetland 16:

| | |
|---|---|
| Human health: | Aroclor-1254 |
| Ecological: | Aluminum, beryllium, iron, manganese, and vanadium. |

#### 2.1.4.5 Wetland 18A

The following COCs in sediment were retained for Wetland 18A:

| | |
|---|---|
| Human health: | Arsenic |
| Ecological: | Barium, iron, manganese, selenium, aldrin, 1,4-dichlorobenzene, and 4-methylphenol (p-cresol). |

Benzene was retained as a human health COC in the RI but was eliminated based on comparison to the child trespasser target risk cancer level ($10^{-6}$) of 11 mg/kg.

#### 2.1.4.6 Wetland 18B

The following COCs in sediment were retained for Wetland 18B:

| | |
|---|---|
| Human health: | Arsenic |
| Ecological: | Iron, manganese, and selenium. |

#### 2.1.4.7 Wetland 48

The following COCs in sediment were retained for Wetland 48 sediment:

| | |
|---|---|
| Ecological: | 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and total DDT. |

#### 2.1.4.8 Wetland 64

The following COCs in sediment were retained for Wetland 64 sediment:

| | |
|---|---|
| Human health: | 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-BCH, alpha-chlordane, Aroclor-1254, Aroclor-1260, delta-BHC, and gamma-chlordane, and BEHP. |
| Ecological: | BEHP, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, vanadium, zinc, endosulfan I, carbozale, and dibenzofuran. |

## 2.2 PRELIMINARY REMEDIATION GOALS FOR CHEMICALS OF CONCERN

Site-specific Remedial Action Objectives (RAOs) specify COCs, media of interest, exposure pathways, and cleanup goals or acceptable contaminant concentrations. This FS addresses sediment contamination at Site 41. The RAOs were developed to permit consideration of institutional controls, monitoring, and containment alternatives based on current and potential future land use. To protect the public from current and potential future health risks, as well as to protect the environment, the following RAOs were developed for Site 41:

- Prevent unacceptable human health risk associated with COCs at concentrations greater than established Preliminary Remediation Goals (PRGs) in sediment at Wetlands 3, 15, 16, 18A, 18B, 48, and 64.

- Reduce, to the extent practicable, unacceptable risk to aquatic receptors exposed to COCs at concentrations greater than established PRGs in sediment at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64.

PRGs are typically target concentrations to which COCs must be reduced within a particular medium of concern to achieve one or more of the established RAOs. PRGs are developed to ensure that contaminant concentrations left on site after remedial action are protective of human and ecological receptors. PRGs were selected based on the results of the HHRA, BERA, toxicity testing, No Observable Effects Concentrations (NOECs) (see Appendix A), and ARARs. COC-specific PRGs for the medium of concern at Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64 (sediment) are identified below.

**PRGs for Wetland 3 COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Arsenic | 7 | HHRA - maintenance worker value |
| Cadmium | 1.8 | Ecological NOEC |
| Iron | 20,800 | Ecological NOEC |
| Endosulfan Sulfate | 0.0023 | Ecological NOEC |

**PRGs for Wetland 5A COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Copper | 25.6 | Ecological NOEC |
| Lead | 82.5 | Ecological NOEC |
| Zinc | 103 | Ecological NOEC |

**PRGs for Wetland 15 COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Arsenic | 7 | HHRA - maintenance worker value |
| 4,4'-DDD | 0.06 | HHRA - recreational fisherman value |
| 4,4'-DDE | 0.04 | HHRA - recreational fisherman value |
| Aroclor-1260 | 0.004 | HHRA - recreational fisherman value |
| delta-BHC | 0.004 | HHRA - recreational fisherman value |
| Aluminum | 5,320 | Ecological NOEC |
| Barium | 4.7 | Ecological NOEC |
| Beryllium | 0.26 | Ecological NOEC |
| Iron | 20,800 | Ecological NOEC |
| Manganese | 39 | Ecological NOEC |
| Selenium | 1 | Ecological NOEC |
| Vanadium | 15.3 | Ecological NOEC |
| Endosulfan I | NA | No value available |
| Heptachlor | NA | No value available |
| 2,2'-oxybis(1-Chloropropane)/ bis(2-chlor) | NA | No value available |
| 2,4-Dimethylphenol | NA | No value available |
| 2-Methylphenol (o-Cresol) | NA | No value available |

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| 4-Methylphenol (p-Cresol) | NA | No value available |
| Phenol | NA | No value available |

**PRGs for Wetland 16 COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Aroclor-1254 | 0.004 | HHRA - recreational fisherman value |
| Aluminum | 5320 | Ecological NOEC |
| Beryllium | 0.26 | Ecological NOEC |
| Iron | 20,800 | Ecological NOEC |
| Manganese | 39 | Ecological NOEC |
| Vanadium | 15.3 | Ecological NOEC |

**PRGs for Wetland 18A COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Arsenic | 7 | HHRA - maintenance worker value |
| Barium | 4.7 | Ecological NOEC |
| Iron | 20,800 | Ecological NOEC |
| Manganese | 39 | Ecological NOEC |
| Selenium | 1 | Ecological NOEC |
| Aldrin | NA | Ecological NOEC |
| 1,4-Dichlorobenzene | NA | No value available |
| 4-Methylphenol (p-Cresol) | NA | No value available |

**PRGs for Wetland 18B COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Arsenic | 6.62 | HHRA - maintenance worker value |
| Iron | 20,800 | Ecological NOEC |
| Manganese | 39 | Ecological NOEC |
| Selenium | 1 | Ecological NOEC |

**PRGs for Wetland 48 COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| 4,4'-DDD | 0.05 | Freshwater reference concentration |
| 4,4'-DDE | 0.04 | Freshwater reference concentration |
| 4,4'-DDT | 0.02 | Freshwater reference concentration |
| Total DDT | 0.11 | Freshwater reference concentration |

**PRGs for Wetland 64 COCs**

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| 4,4'-DDD | 0.06 | HHRA - recreational fisherman value |
| 4,4'-DDE | 0.04 | HHRA - recreational fisherman value |
| 4,4'-DDT | 0.04 | HHRA - recreational fisherman value |
| Aldrin | 0.0004 | HHRA - recreational fisherman value |
| alpha-BHC | 0.004 | HHRA - recreational fisherman value |
| alpha-Chlordane | 0.02 | HHRA - recreational fisherman value |
| Aroclor-1254 | 0.004 | HHRA - recreational fisherman value |
| Aroclor-1260 | 0.004 | HHRA - recreational fisherman value |
| gamma-Chlordane | 0.02 | HHRA - recreational fisherman value |
| BEHP | 1.4 | HHRA - recreational fisherman value |
| Aluminum | 7,600 | Ecological NOEC |
| Barium | 17 | Ecological NOEC |
| Beryllium | 0.34 | Ecological NOEC |
| Cadmium | 17.7 | Ecological NOEC |
| Chromium | 592 | Ecological NOEC |
| Cobalt | 3.4 | Ecological NOEC |
| Copper | 146 | Ecological NOEC |
| Lead | 330 | Ecological NOEC |
| Manganese | 65.8 | Ecological NOEC |
| Mercury* | NA | No value available |

| Sediment COC | PRG (mg/kg) | Rationale |
|---|---|---|
| Selenium | 1.5 | Ecological NOEC |
| Silver | 3 | Ecological NOEC |
| Vanadium | 15.9 | Ecological NOEC |
| Zinc | 306 | Ecological NOEC |
| Endosulfan I | NA | No value available |
| Carbozale | 0.35 | Ecological NOEC |
| Dibenzofuran | 0.13 | Ecological NOEC |

* Mercury was not retained as a COC for risks to sediment invertebrates because it was detected at concentrations that did not exceed its refinement value. Mercury was retained as a COC because, based on estimated mercury exposure concentrations, there was potential for unacceptable risk to predatory fish foraging in OU 2 wetlands. However, although risks were much lower using actual fish tissue concentrations, the ERA concluded that the FS should evaluate and uptake of mercury in predatory fish in Wetland 64. A cleanup level based on this exposure pathway cannot be determined using the actual fish tissue data, because a site-specific sediment to fish bioaccumulation factor was not calculated, and using the literature based accumulation factor will overestimate risks and thus result in a lower than necessary PRG.

## 2.3 GRAS AND ACTION-SPECIFIC ARARS

GRAs are broadly defined remedial approaches that may be used by themselves or in combination with one or more of the other approaches to attain the RAOs.

### 2.3.1 GRAs

GRAs describe categories of actions that could be implemented to satisfy or address a component of the RAOs for the site. Remedial action alternatives are then assembled by identifying types of treatment technologies and process options associated with these technologies according to the GRAs. The technologies and process options are then screened and evaluated using GRAs individually or in combination to develop the remedial alternatives.

#### 2.3.1.1 Sediment

The following GRAs are considered practical for sediment at Wetland 3:

- No Action
- Limited Action [Land Use Controls (LUCs), monitoring, and Natural Recovery]

The following GRAs are considered practical for sediment at Wetlands 5A,15, 16, 18A, 18B, 48, and 64:

- No Action
- Limited Action (LUCs and Natural Recovery)
- Removal
- Disposal

## 2.4 ESTIMATED VOLUMES OF CONTAMINATED SEDIMENT

Calculations were performed to determine the volumes of contaminated sediment with COC concentrations greater than PRGs in Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64.

### 2.4.1 Wetland 3

The human health area of concern (areas with COC concentrations greater than PRGs) is estimated to contain 400 cubic yards of contaminated sediment and is completely encompassed within the ecological area of concern. The ecological areas of concern are estimated to have a volume of 695 cubic yards of contaminated sediment. The overall contaminated sediment volume is estimated to be 695 cubic yards. The human health and ecological areas of concern are shown on Figure 2-1.

### 2.4.2 Wetland 5A

The contaminated sediment volume based on ecological screening values is estimated to be 1,275 cubic yards. The ecological areas of concern are shown on Figure 2-2.

### 2.4.3 Wetland 15

The human health areas of concern (areas with COC concentrations greater than PRGs) are estimated to contain 845 cubic yards of contaminated sediment and are completely encompassed within the ecological area of concern. The ecological areas of concern are estimated to have a volume of 1,400 cubic yards of contaminated sediment. The overall contaminated sediment volume is estimated to be 1,400 cubic yards. The human health and ecological areas of concern are shown on Figure 2-3.

### 2.4.4 Wetland 16

The human health areas of concern (areas with COC concentrations greater than PRGs) are estimated to contain 75 cubic yards of contaminated sediment and are completely encompassed within the ecological area of concern. The ecological areas of concern are estimated to have a volume of 330 cubic yards of contaminated sediment. The overall contaminated sediment volume is estimated to be 330 cubic yards. The human health and ecological areas of concern are shown on Figure 2-4.

### 2.4.5 Wetland 18A

The ecological area of concern (areas with COC concentrations greater than PRGs) is estimated to contain 75 cubic yards of contaminated sediment and is completely encompassed within one of the human health areas of concern. The human health areas of concern are estimated to have a volume of 150 cubic yards of contaminated sediment. The overall contaminated sediment volume is estimated to be 150 cubic yards. The human health and ecological areas of concern are shown on Figure 2-5.

### 2.4.6 Wetland 18B

The human health and ecological areas of concern are estimated to have a volume of 150 cubic yards of contaminated sediment. The human health and ecological area of concern are shown on Figure 2-6.

### 2.4.7 Wetland 48

The ecological area of concern is estimated to have a volume of 6,580 cubic yards of contaminated sediment. The human health and ecological area of concern are shown on Figure 2-7.

### 2.4.8 Wetland 64

The ecological areas of concern are estimated to contain 14,390 cubic yards of contaminated sediment and are completely encompassed within the human health area of concern. The human health area of concern is estimated to have a volume of 23,580 cubic yards of contaminated sediment. The overall contaminated sediment volume is estimated to be 23,580 cubic yards. The human health and ecological areas of concern are shown on Figure 2-8.

TABLE 2-1

**FEDERAL CHEMICAL-SPECIFIC ARARs and TBCs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**

| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| United States Environmental Protection Agency (USEPA) Region 3 Risk-Based Criteria (RBCs) | NA | Relevant and Appropriate | Can be used to estimate risk and develop risk-based cleanup goals | Considered for determining areas of the site that pose an unacceptable risk and for developing Preliminary Remediation Goals (PRGs). |
| Cancer Slope Factors (CSFs) | NA | Relevant and Appropriate | CSFs are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. | CSFs were considered for development of human health protection PRGs for sediment at this site. |
| Reference Doses (RfDs) | NA | Relevant and Appropriate | RFDs are guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants. | RFDs were considered for development of human health protection PRGs for sediment at this site. |

NA – Not applicable.

**TABLE 2-2**

**STATE CHEMICAL-SPECIFIC ARARs and TBCs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**

| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Contaminant Cleanup Target Levels Rule | Chapter 62-777, Florida Administrative Code (F.A.C.) | Relevant and Applicable | This document provides guidance for soil, groundwater, and surface water cleanup levels that can be developed on a site-by-site basis. | These guidelines were used in determining Preliminary Remediation Goals (PRGs) for surface water. |
| Contaminated Site Cleanup Criteria Rule | Chapter 62-780, F.A.C. | Relevant and Applicable | This document provides a phased risk-based corrective action process that is iterative and that tailors site rehabilitation tasks to site-specific conditions and risks. | These guidelines were used in determining PRGs for surface water. |

**TABLE 2-3**

**FEDERAL LOCATION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**
**PAGE 1 OF 2**

| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Endangered Species Act Regulations | 50 CFR Parts 81, 225, 402 | Applicable | This act requires federal agencies to take action to avoid jeopardizing the continued existence of federally listed endangered or threatened species. | If a site investigation or remediation could potentially affect an endangered species or their habitat, these regulations would apply. |
| Fish and Wildlife Coordination Act Regulations | 33 CFR Subsection 320.3 | Applicable | Requires that the United States Fish and Wildlife Service, National Marine Fisheries Service, and related state agencies be consulted prior to structural modification of any body of water, including wetlands. If modifications must be conducted, the regulation requires that adequate protection be provided for fish and wildlife resources. | If a remedial alternative involves the alteration of a stream or wetland, these agencies would be consulted. |
| National Environmental Policy Act (NEPA) Regulations, Wetlands, Floodplains, etc. | 40 CFR Subsection 6.302 [a] | Applicable | These regulations contain procedures for complying with Executive Order 11990 on wetlands protection. Appendix A states that no remedial alternative adversely affect a wetland if another practicable alternative is available. If no alternative is available, impacts from implementing the chosen alternative must be mitigated. | If remedial action affects a wetland, these regulations would apply. |
| NEPA Regulations, Floodplain Management, Executive Order | 40 CFR Part 6, Appendix A | Applicable | Appendix A describes the policy for carrying out the Executive Order regarding floodplains. If no practicable alternative exists to performing cleanup in a floodplain, | If removal actions take place in a floodplain, alternatives would be considered that would reduce the risk of flood loss and restore and preserve the floodplain. |

**TABLE 2-3**

**FEDERAL LOCATION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| 11988 | | | potential harm must be mitigated and actions taken to preserve the beneficial value of the floodplain. | |
| Fish and Wildlife Conservation Act | 40 CFR Section 6.302 | Applicable | Requires action to be taken to protect fish and wildlife from projects affecting streams or rivers. | United States Fish and Wildlife Service officials would be consulted on how to minimize impacts of any remedial activities on fish and wildlife. |

**TABLE 2-4**

**STATE LOCATION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**

| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Florida Rules Related to Endangered or Threatened Species | Chapter 68A-27, Florida Administrative Code (F.A.C.) | Applicable | Sets requirements for areas where threatened or endangered species exist | An evaluation of the presence of threatened or endangered species will be conducted prior to invasive remedial actions. |

**TABLE 2-5**

**FEDERAL ACTION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Resource Conservation and Recovery Act (RCRA) Regulations, Identification, and Listing of Hazardous Wastes | 40 Code of Federal Regulations (CFR) Part 261 | Applicable | Defines the listed and characteristic hazardous wastes subject to RCRA. Appendix II contains the Toxicity Characteristic Leaching Procedure. | These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic, as described in the regulations. |
| Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards | 29 Code of Federal Regulations (CFR) Part 1910 | Applicable | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | These regulations would apply to the Site 41 response activities. |
| OSHA Regulations | 29 CFR Part 1910, Subpart Z | Applicable | Establishes permissible exposure limits for workplace exposure to a specific list of chemicals. | Standards are applicable for worker exposure to OSHA hazardous chemicals during remedial activities. |
| OSHA Regulations, Recordkeeping, Reporting, and Related Regulations | 29 CFR Part 1904 | Applicable | Provides recordkeeping and reporting requirements applicable to remedial activities. | These requirements apply to site contractors and subcontractors and must be followed during the site work. |
| OSHA Regulations, Health and Safety Standards | 29 CFR Part 1926 | Applicable | Specifies the type of safety training, equipment, and procedures to be used during site investigation and remediation. | Phases of the remedial response project would be executed in compliance with this regulation. |

**TABLE 2-5**

**FEDERAL ACTION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| RCRA Regulations, Identification and Listing of Hazardous Wastes | 40 CFR Part 261 | Applicable | Defines the listed and characteristic hazardous wastes subject to RCRA. | These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic, as described in the regulations. |
| Clean Water Act (CWA), National Pollution Discharge Elimination System (NPDES) | 40 CFR Parts 122 through 125, and 131 | Applicable | NPDES permits are required for any discharges to navigable waters. If remedial activities include such a discharge, the NPDES standards would be ARARs. | Any alternative that involves discharges into any navigable water would require compliance with these regulations, including treatment if necessary. |
| Migratory Bird Treaty Act | 16 United States Code (U.S.C.) 703-711 | Applicable | Protects migratory birds and their nests. | Proposed actions will not kill migratory birds or destroy their nests and eggs. |

**TABLE 2-6**

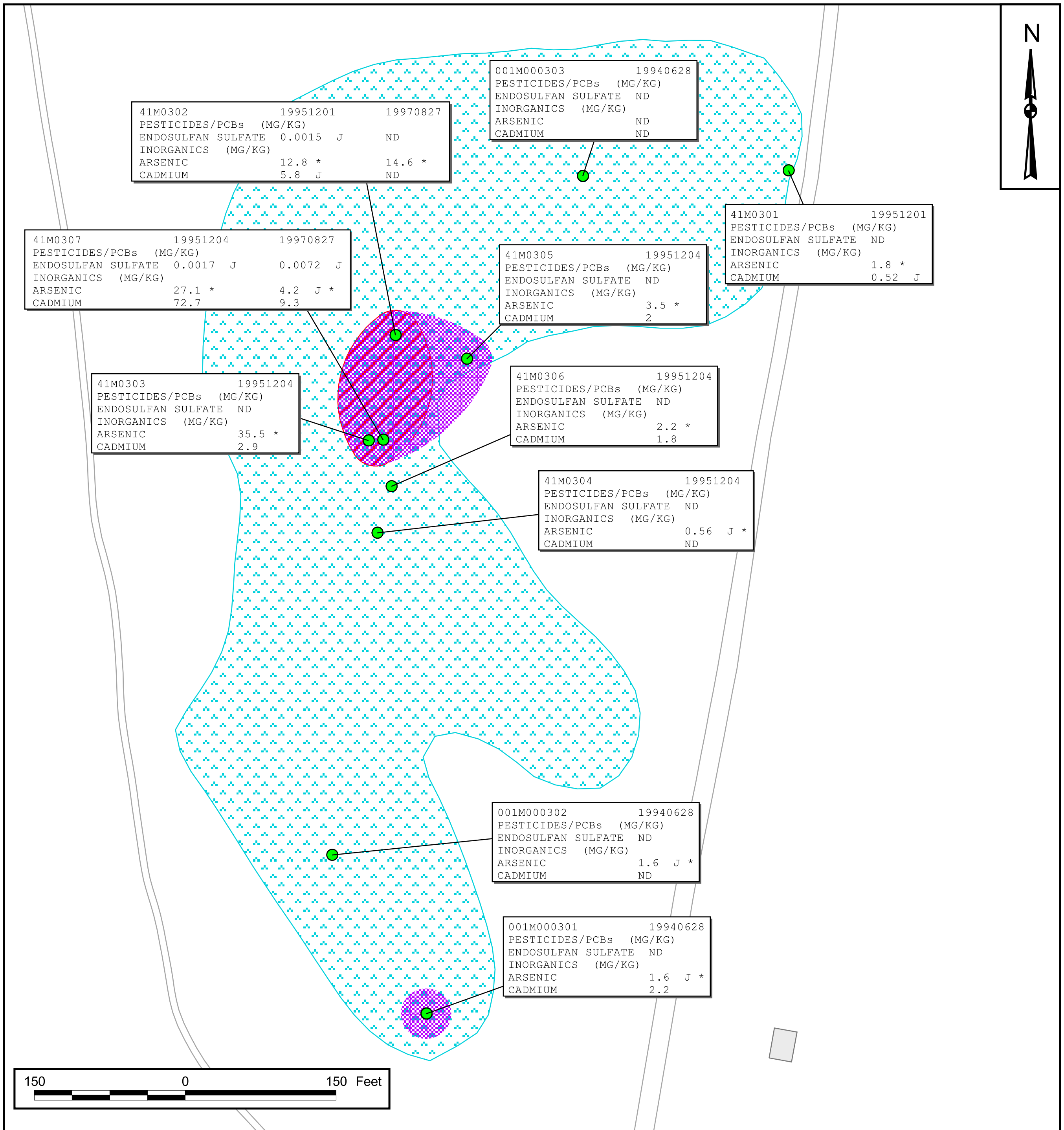
**STATE ACTION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| Florida Hazardous Waste Rules – October 1993 | Chapter 62-730, Florida Administration Code (F.A.C.) | Applicable | Adopts by reference sections of the federal hazardous waste regulations and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | These regulations would apply if waste on site was deemed hazardous and needed to be stored, transported, or properly disposed. |
| Florida Dredge and Fill Activities | Chapter 62-312, F.A.C. | Applicable | This rule establishes requirements for dredging, filling, excavating, or placing material in or over the waters of the state, including wetlands. | The requirements of these rules were considered when developing and implementing remedial activities that involve waters of the state. |
| Florida Air Pollution Rules – October 1992 | Chapter 62-2, F.A.C. | Applicable | Establishes permitting requirements for owners or operators of any source that emits any air pollutant. This rule also establishes ambient air quality standards for sulfur dioxide, carbon monoxide, lead, and ozone. | Although this rule is directly applicable to industrial polluters, these requirements are relevant and appropriate for a remedial action that could result in release of regulated contaminants to the atmosphere, such as may occur during excavation. |
| Florida Regulation of Stormwater Discharge – May 1993 | Chapter 62-25, F.A.C. | Applicable | Establishes requirements for discharges of untreated stormwater to ensure protection of the surface water of the state. | Remedial actions would consider the impact of discharge of untreated stormwater from the site. |
| Florida Ambient Air Quality Standards – December 1994 | Chapter 62-272, F.A.C. | Applicable | Establishes ambient air quality standards necessary to protect human health and public welfare. It also establishes maximum | These ambient air quality standards would be met for remedial actions involving the possible release of contaminants to the atmosphere. |

**TABLE 2-6**

**STATE ACTION-SPECIFIC ARARs**
**SITE 41 FEASIBILITY STUDY REPORT**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Requirement | Citation | Status | Synopsis | Evaluation/Action to be Taken |
|---|---|---|---|---|
| | | | allowable increases in ambient concentrations for subject pollutants to prevent significant deterioration of air quality in areas where ambient air quality standards are being met. Approved air quality monitoring methods are also specified. | |
| Air Pollution Episodes – September 1994 | Chapter 62-273, F.A.C. | Applicable | This rule classifies an air episode as an air alert, warning, or emergency and establishes criteria for determining the level of the air episode. It also establishes response requirements for each level. | These regulations would be adhered to if remedial actions involve air emissions. |




NAVFAC Naval Facilities Engineering Command
NAVFAC WASHINGTON

Figure 2-1
Wetland 3
COCs in Sediment
Site 41 Feasibility Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- HHRA AOC
- Ecological AOC

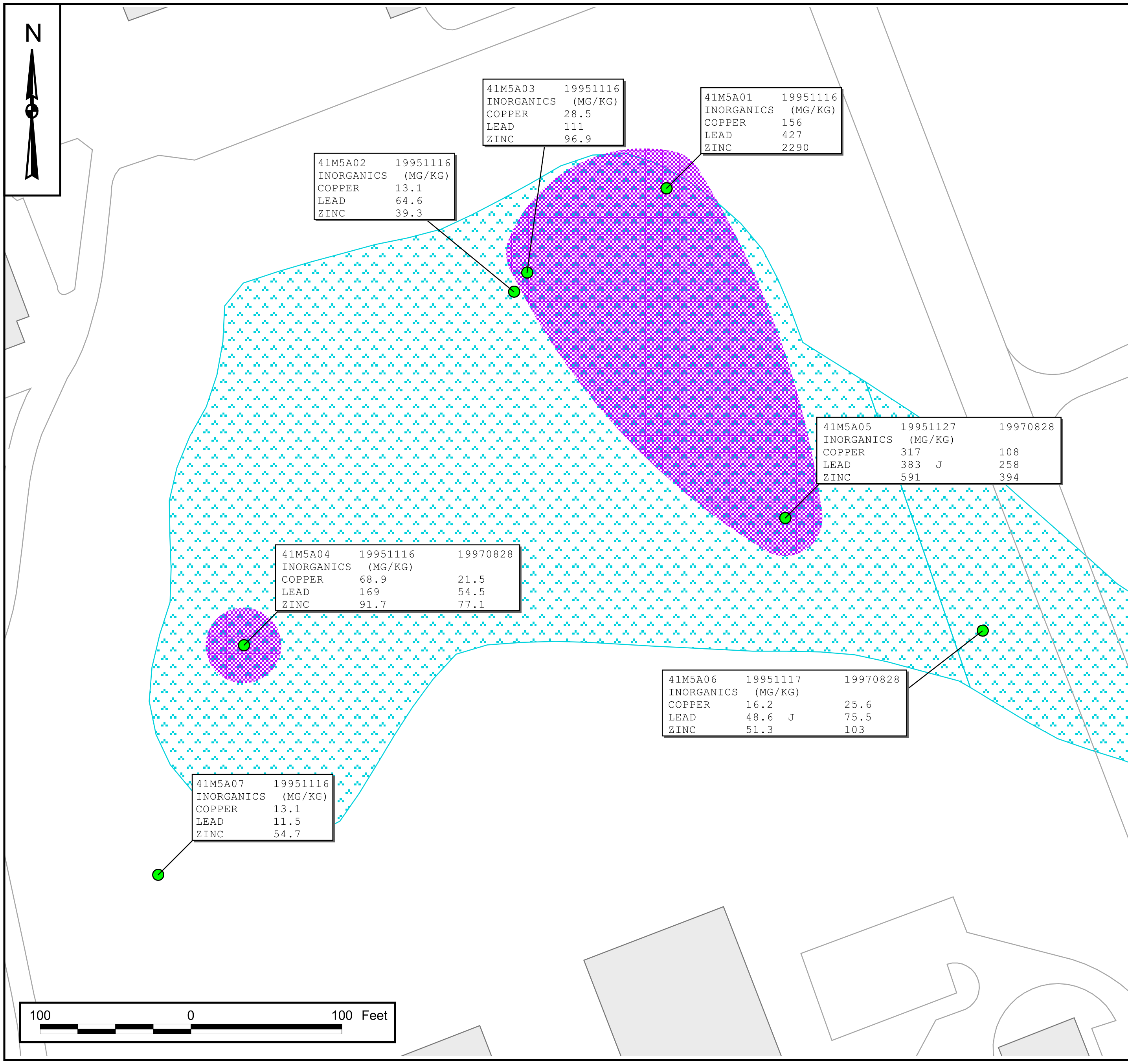
NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 3 is considered a freshwater wetland

TETRA TECH

Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/23/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 3 SD AOC LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

# Figure 2-2
# Wetland 5A
# COCs in Sediment
# Site 41 Feasibility Study Report
# NAS Pensacola
# Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- Ecological AOC

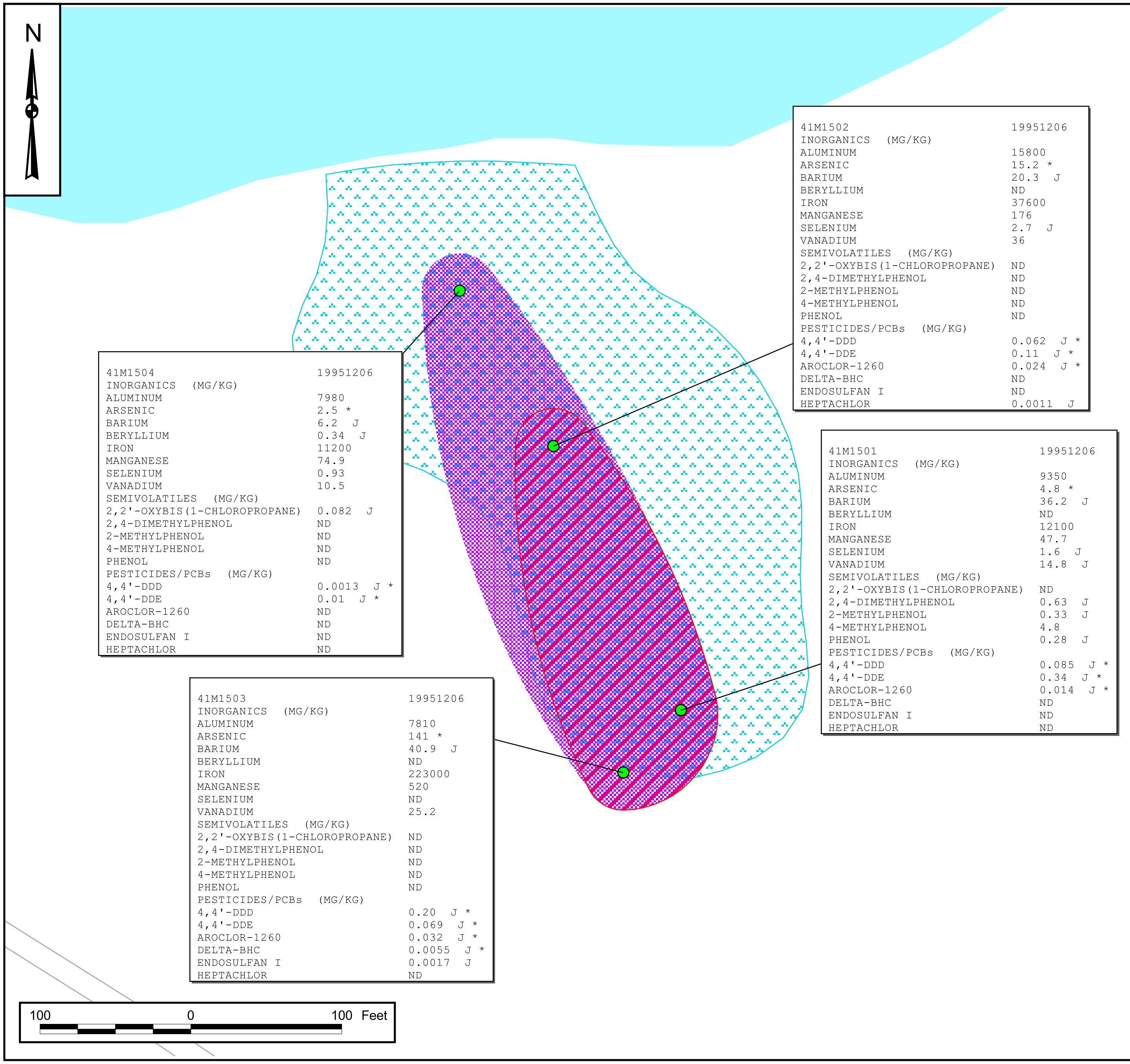
NOTES:
1. J - estimated value
2. Wetland 5A is considered a freshwater wetland

TETRA TECH

Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 5A SD AOC TAG LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

# Figure 2-3
# Wetland 15
# COCs in Sediment
# Site 41 Feasibility Study Report
# NAS Pensacola
# Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Water
- HHRA AOC
- Ecological AOC

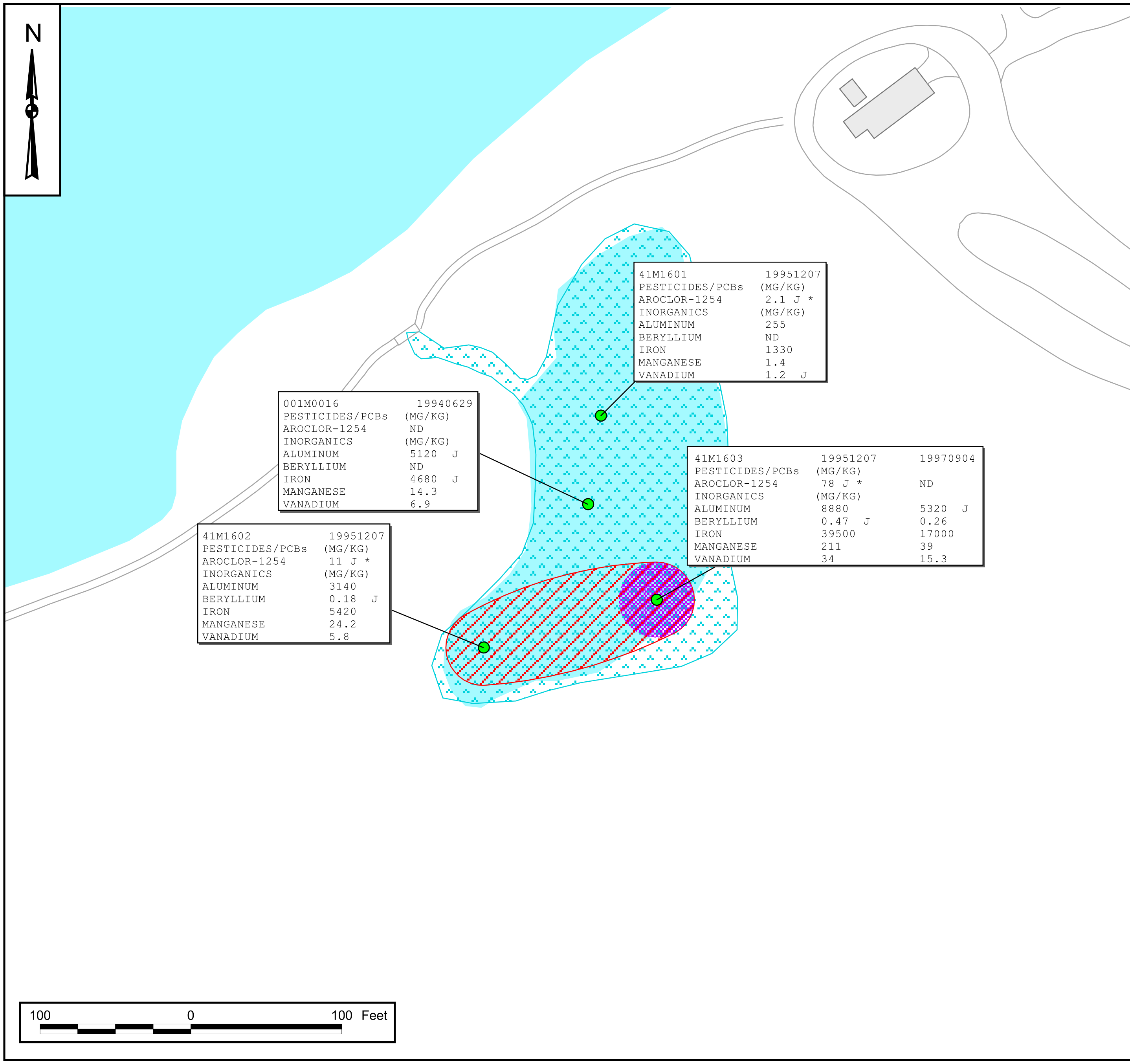
NOTES:
1. J - estimated value
2. * HHRA COC
3. Wetland 15 is considered a saltwater wetland

TETRA TECH

Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 15 SD AOC LAYOUT 7/23/09 KM




NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

Figure 2-4
Wetland 16
COCs in Sediment
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- Water
- HHRA AOC
- Ecological AOC

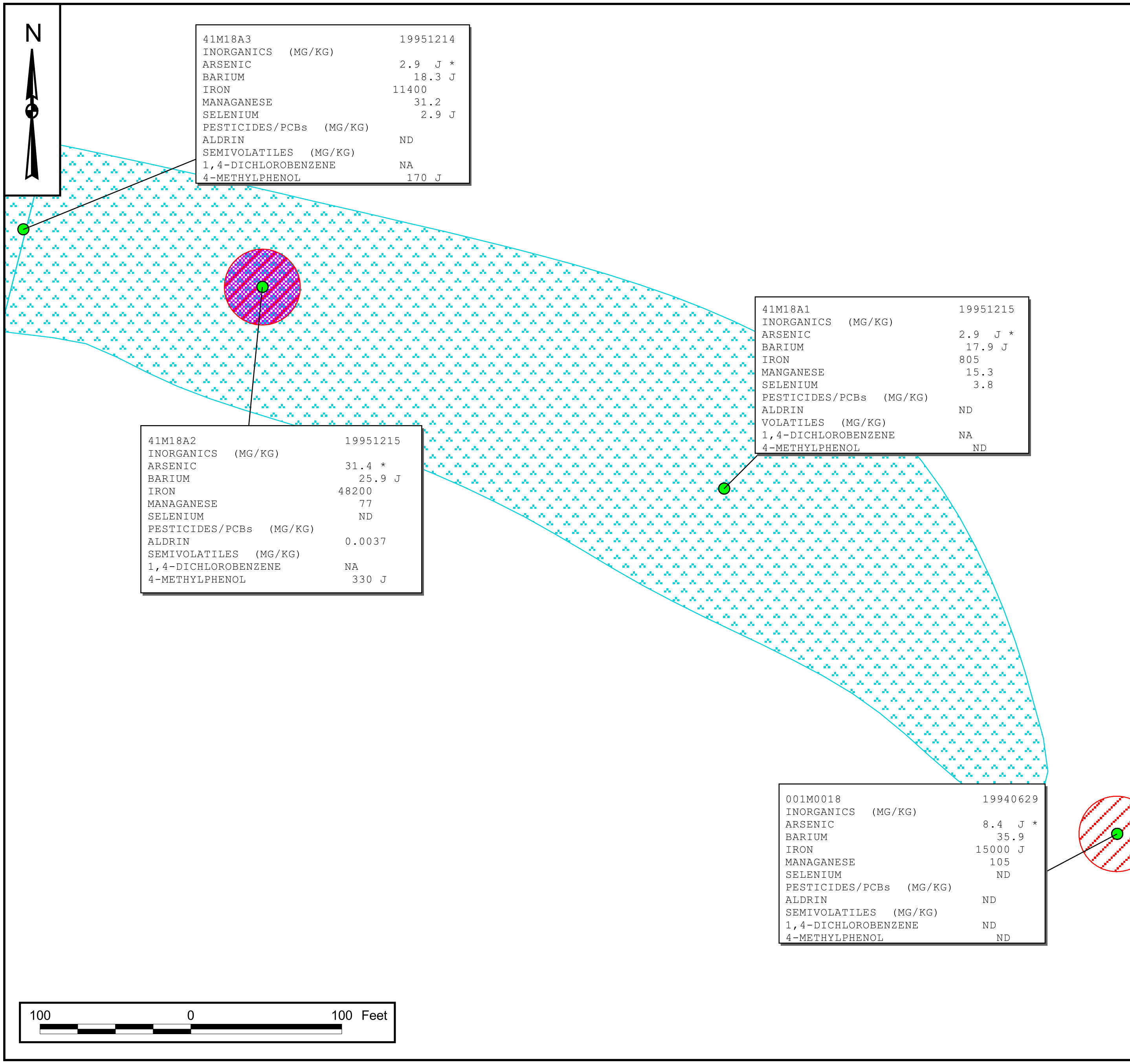
NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 16 is considered a saltwater wetland

TETRA TECH

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 16 SD AOC LAYOUT 7/23/09 KM




NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

Figure 2-5
Wetland 18A
COCs in Sediment
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND
- Sample Location
- Wetland
- HHRA AOC
- Ecological AOC

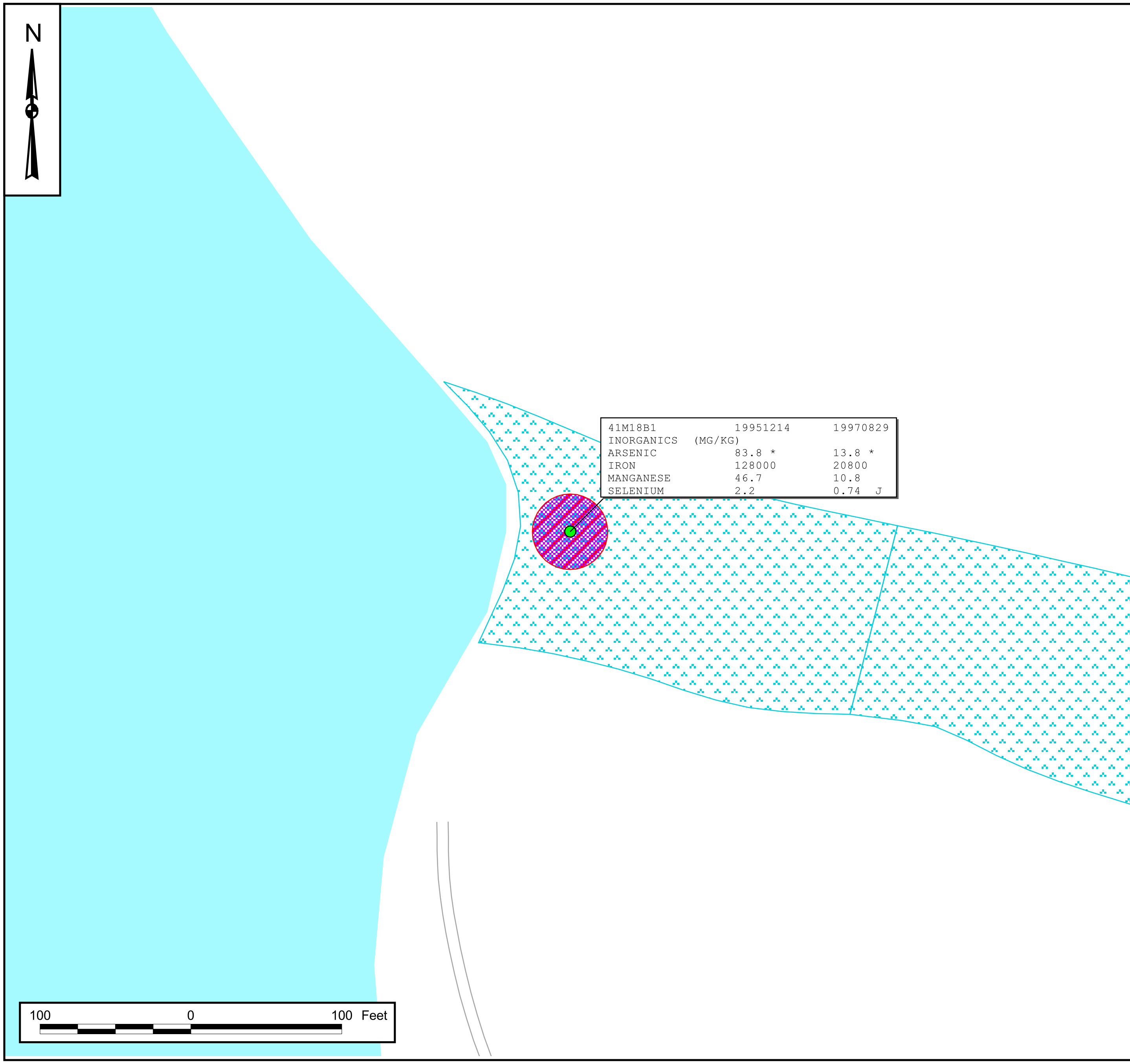
NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 18A is considered a freshwater wetland

TETRA TECH

Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 18A SD AOC LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

Figure 2-6
Wetland 18B
COCs in Sediment
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Water
- HHRA AOC
- Ecological AOC

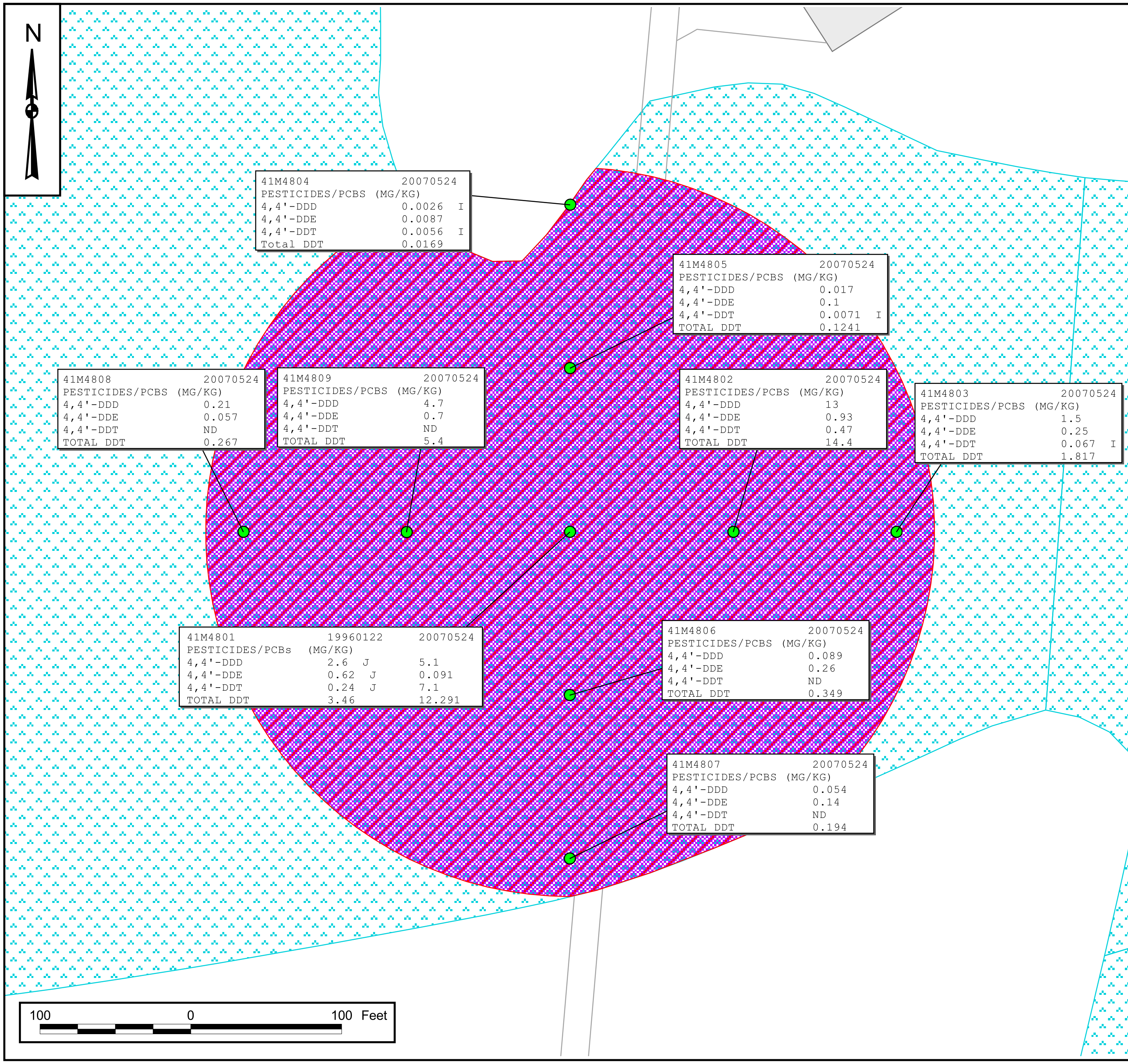
NOTES:
1. J - esitmated value
2. * HHRA COCs
3. Wetland 18B is considered a saltwater wetland

TETRA TECH

Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 18B SD AOC LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

Figure 2-7
Wetland 48
COCs in Sediment
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- HHRA AOC
- Ecological AOC

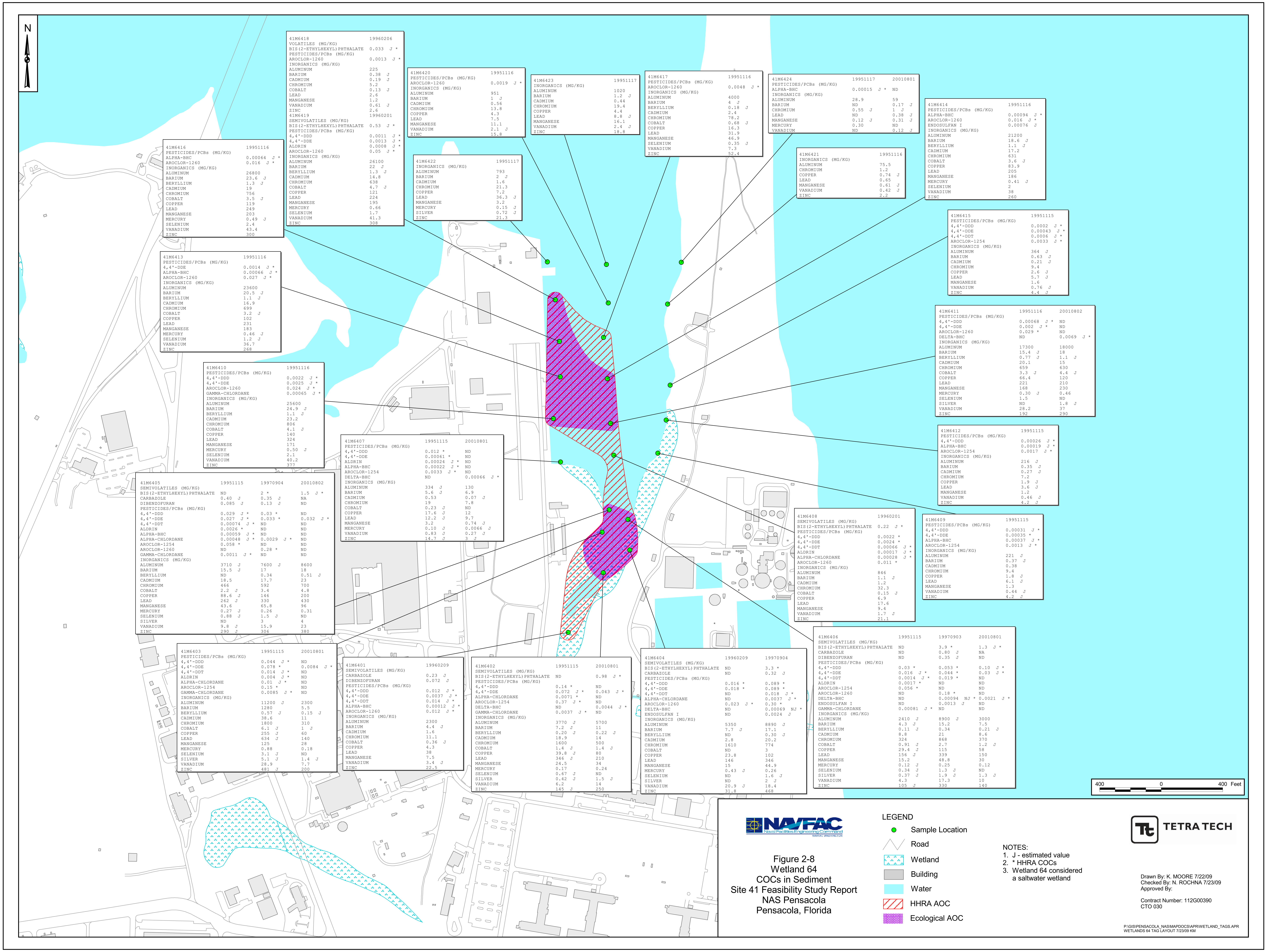
NOTES:
1. * HHRA COCs
2. Wetland 48 is considered a freshwater wetland

TETRA TECH

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 48 SD AOC LAYOUT 7/23/09 KM



N
41M6418 19960206
VOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE 0.033 J *
PESTICIDES/PCBs (MG/KG)
AROCLOR-1260 0.0013 J *
INORGANICS (MG/KG)
ALUMINUM 225
BARIUM 0.38 J
CADMIUM 0.19 J
CHROMIUM 5.2
COBALT 0.13 J
LEAD 2.6
MANGANESE 1.2
VANADIUM 0.61 J
ZINC 2.6
41M6419 19960201
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE 0.53 J *
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.0011 J *
4,4'-DDE 0.0013 J *
ALDRIN 0.0008 J *
AROCLOR-1260 0.05 J *
INORGANICS (MG/KG)
ALUMINUM 26100
BARIUM 22 J
BERYLLIUM 1.3 J
CADMIUM 14.8
CHROMIUM 638
COBALT 4.7 J
COPPER 121
LEAD 224
MANGANESE 195
MERCURY 0.66
SELENIUM 1.7
VANADIUM 41.3
ZINC 308
41M6420 19951116
PESTICIDES/PCBs (MG/KG)
AROCLOR-1260 0.0019 J *
INORGANICS (MG/KG)
ALUMINUM 951
BARIUM 1 J
CADMIUM 0.56
CHROMIUM 13.8
COPPER 4.3
LEAD 7.5
MANGANESE 11.1
VANADIUM 2.1 J
ZINC 15.8
41M6423 19951117
INORGANICS (MG/KG)
ALUMINUM 1020
BARIUM 1.2 J
CADMIUM 0.44
CHROMIUM 19.4
COPPER 4.4
LEAD 8.8 J
MANGANESE 16.1
VANADIUM 2.4 J
ZINC 18.8
41M6417 19951116
PESTICIDES/PCBs (MG/KG)
AROCLOR-1260 0.0048 J *
INORGANICS (MG/KG)
ALUMINUM 4000
BARIUM 4 J
BERYLLIUM 0.18 J
CADMIUM 2.4
CHROMIUM 78.2
COBALT 0.68 J
COPPER 16.3
LEAD 31.9
MANGANESE 46.9
SELENIUM 0.35 J
VANADIUM 7.3
ZINC 52.4
41M6424 19951117 20010801
PESTICIDES/PCBs (MG/KG)
ALPHA-BHC 0.00015 J * ND
INORGANICS (MG/KG)
ALUMINUM 28.9 59
BARIUM ND 0.17 J
CHROMIUM 0.55 J 1 J
LEAD ND 0.38 J
MANGANESE 0.12 J 0.31 J
MERCURY 0.30 ND
VANADIUM ND 0.12 J
41M6414 19951116
PESTICIDES/PCBs (MG/KG)
ALPHA-BHC 0.00094 J *
AROCLOR-1260 0.016 J *
ENDOSULFAN I 0.00076 J
INORGANICS (MG/KG)
ALUMINUM 21200
BARIUM 18.6 J
BERYLLIUM 1.1 J
CADMIUM 17.2
CHROMIUM 631
COBALT 3.6 J
COPPER 83.9
LEAD 205
MANGANESE 186
MERCURY 0.41 J
SELENIUM 2
VANADIUM 38
ZINC 260
41M6416 19951116
PESTICIDES/PCBs (MG/KG)
ALPHA-BHC 0.00064 J *
AROCLOR-1260 0.016 J *
INORGANICS (MG/KG)
ALUMINUM 26800
BARIUM 23.6 J
BERYLLIUM 1.3 J
CADMIUM 19
CHROMIUM 756
COBALT 3.5 J
COPPER 119
LEAD 249
MANGANESE 203
MERCURY 0.49 J
SELENIUM 2.4
VANADIUM 43.4
ZINC 300
41M6422 19951117
INORGANICS (MG/KG)
ALUMINUM 793
BARIUM 2 J
CADMIUM 1.6
CHROMIUM 21.3
COPPER 7.2
LEAD 36.3 J
MANGANESE 3.2
MERCURY 0.15 J
SILVER 0.72 J
ZINC 21.3
41M6421 19951116
INORGANICS (MG/KG)
ALUMINUM 75.5
CHROMIUM 1.2
COPPER 0.74 J
LEAD 0.65
MANGANESE 0.61 J
VANADIUM 0.42 J
ZINC 2.2
41M6415 19951115
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.0002 J *
4,4'-DDE 0.00043 J *
4,4'-DDT 0.0006 J *
AROCLOR-1254 0.0033 J *
INORGANICS (MG/KG)
ALUMINUM 364 J
BARIUM 0.63 J
CADMIUM 0.21 J
CHROMIUM 9.4
COPPER 2.6 J
LEAD 5.7 J
MANGANESE 1.6
VANADIUM 0.76 J
ZINC 4.4 J
41M6413 19951116
PESTICIDES/PCBs (MG/KG)
4,4'-DDE 0.0014 J *
ALPHA-BHC 0.00066 J *
AROCLOR-1260 0.027 J *
INORGANICS (MG/KG)
ALUMINUM 23600
BARIUM 20.5 J
BERYLLIUM 1.1 J
CADMIUM 16.9
CHROMIUM 699
COBALT 3.2 J
COPPER 102
LEAD 231
MANGANESE 183
MERCURY 0.46 J
SELENIUM 1.2 J
VANADIUM 36.7
ZINC 268
41M6411 19951116 20010802
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.00068 J * ND
4,4'-DDE 0.002 J * ND
AROCLOR-1260 0.029 * ND
DELTA-BHC ND 0.0069 J *
INORGANICS (MG/KG)
ALUMINUM 17300 18000
BARIUM 15.4 J 18
BERYLLIUM 0.77 J 1.1 J
CADMIUM 20.1 15
CHROMIUM 659 630
COBALT 3.3 J 4.4 J
COPPER 66.4 120
LEAD 221 210
MANGANESE 168 230
MERCURY 0.30 J 0.46
SELENIUM 1.5 ND
SILVER ND 1.8 J
VANADIUM 28.2 37
ZINC 192 290
41M6410 19951116
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.0022 J *
4,4'-DDE 0.0025 J *
AROCLOR-1260 0.024 J *
GAMMA-CHLORDANE 0.00065 J *
INORGANICS (MG/KG)
ALUMINUM 25600
BARIUM 24.9 J
BERYLLIUM 1.1 J
CADMIUM 23.2
CHROMIUM 806
COBALT 4.1 J
COPPER 140
LEAD 324
MANGANESE 171
MERCURY 0.50 J
SELENIUM 2.1
VANADIUM 40.2
ZINC 377
41M6407 19951115 20010801
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.012 * ND
4,4'-DDE 0.00061 * ND
ALDRIN 0.00024 J * ND
ALPHA-BHC 0.00022 J * ND
AROCLOR-1254 0.0033 J * ND
DELTA-BHC ND 0.00066 J *
INORGANICS (MG/KG)
ALUMINUM 334 J 130
BARIUM 5.6 J 6.9
CADMIUM 0.53 0.07 J
CHROMIUM 19 7.8
COBALT 0.23 J ND
COPPER 17.6 J 12
LEAD 12.2 J 9.7
MANGANESE 3.2 0.74 J
MERCURY 0.10 J 0.0066 J
VANADIUM 0.83 J 0.27 J
ZINC 14.7 J 3 J
41M6412 19951115
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.00026 J *
ALPHA-BHC 0.00019 J *
AROCLOR-1254 0.0017 J *
INORGANICS (MG/KG)
ALUMINUM 216 J
BARIUM 0.35 J
CADMIUM 0.27 J
CHROMIUM 7.2
COPPER 1.9 J
LEAD 3.6 J
MANGANESE 1.2
VANADIUM 0.46 J
ZINC 4.2 J
41M6405 19951115 19970904 20010802
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE ND 2 * 1.5 J *
CARBAZOLE 0.40 J 0.35 J NA
DIBENZOFURAN 0.085 J 0.13 J ND
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.029 J * 0.03 * ND
4,4'-DDE 0.027 J * 0.033 * 0.032 J *
4,4'-DDT 0.00074 J * ND ND
ALDRIN 0.0026 * ND ND
ALPHA-BHC 0.00059 J * ND ND
ALPHA-CHLORDANE 0.00048 J * 0.0029 J * ND
AROCLOR-1254 0.058 * ND ND
AROCLOR-1260 ND 0.28 * ND
GAMMA-CHLORDANE 0.0011 J * ND ND
INORGANICS (MG/KG)
ALUMINUM 3710 J 7600 J 8600
BARIUM 15.5 J 17 18
BERYLLIUM ND 0.34 0.51 J
CADMIUM 18.5 17.7 23
CHROMIUM 466 592 700
COBALT 2.2 J 3.4 4.8
COPPER 88.6 J 146 200
LEAD 262 J 330 430
MANGANESE 43.6 65.8 96
MERCURY 0.27 J 0.26 0.31
SELENIUM 0.88 J 1.5 J ND
SILVER ND 3 4
VANADIUM 9.8 J 15.9 23
ZINC 290 J 306 380
41M6408 19960201
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE 0.22 J *
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.0022 *
4,4'-DDE 0.0024 *
4,4'-DDT 0.00066 J *
ALDRIN 0.00017 J *
ALPHA-CHLORDANE 0.00028 J *
AROCLOR-1260 0.011 *
INORGANICS (MG/KG)
ALUMINUM 846
BARIUM 1.1 J
CADMIUM 1.2
CHROMIUM 32.3
COBALT 0.15 J
COPPER 6.9
LEAD 17.6
MANGANESE 9.4
VANADIUM 1.7 J
ZINC 21.1
41M6409 19951115
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.00031 J *
4,4'-DDE 0.00035 J *
ALPHA-BHC 0.00037 J *
AROCLOR-1254 0.0013 J *
INORGANICS (MG/KG)
ALUMINUM 221 J
BARIUM 0.37 J
CADMIUM 0.38
CHROMIUM 9.4
COPPER 1.8 J
LEAD 6.1 J
MANGANESE 1.3
VANADIUM 0.44 J
ZINC 4.2 J
41M6403 19951115 20010801
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.044 J * ND
4,4'-DDE 0.078 * 0.0084 J *
4,4'-DDT 0.014 J * ND
ALDRIN 0.004 J * ND
ALPHA-CHLORDANE 0.01 J * ND
AROCLOR-1254 0.15 * ND
GAMMA-CHLORDANE 0.0085 J * ND
INORGANICS (MG/KG)
ALUMINUM 11200 J 2300
BARIUM 1280 5.5
BERYLLIUM 0.57 J 0.15 J
CADMIUM 38.6 11
CHROMIUM 1800 310
COBALT 6.1 J 1 J
COPPER 255 J 60
LEAD 634 J 140
MANGANESE 125 28
MERCURY 0.88 0.18
SELENIUM 3.1 J ND
SILVER 5.1 J 1.4 J
VANADIUM 28.9 7.7
ZINC 481 J 200
41M6401 19960209
SEMIVOLATILES (MG/KG)
CARBAZOLE 0.23 J
DIBENZOFURAN 0.072 J
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.012 J *
4,4'-DDE 0.0037 J *
4,4'-DDT 0.014 J *
ALPHA-BHC 0.00012 J *
AROCLOR-1260 0.012 J *
INORGANICS (MG/KG)
ALUMINUM 2300
BARIUM 4.4 J
CADMIUM 1.6
CHROMIUM 11.1
COBALT 0.36 J
COPPER 4.3
LEAD 38
MANGANESE 7.5
VANADIUM 3.4 J
ZINC 22.5
41M6402 19951115 20010801
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE ND 0.98 J *
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.14 * ND
4,4'-DDE 0.072 J * 0.043 J *
ALPHA-CHLORDANE 0.0071 * ND
AROCLOR-1254 0.37 J * ND
DELTA-BHC ND 0.0044 J *
GAMMA-CHLORDANE 0.0037 J * ND
INORGANICS (MG/KG)
ALUMINUM 3770 J 5700
BARIUM 7.2 J 11
BERYLLIUM 0.20 J 0.22 J
CADMIUM 18.9 14
CHROMIUM 1600 500
COBALT 1.4 J 1.4 J
COPPER 39.8 J 80
LEAD 346 J 210
MANGANESE 24.5 34
MERCURY 0.17 0.24
SELENIUM 0.67 J ND
SILVER 0.42 J 1.5 J
VANADIUM 6.2 14
ZINC 145 J 250
41M6404 19960209 19970904
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE ND 3.3 *
CARBAZOLE ND 0.32 J
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.016 * 0.089 *
4,4'-DDE 0.018 * 0.089 *
4,4'-DDT ND 0.018 J *
ALPHA-CHLORDANE ND 0.0037 J *
AROCLOR-1260 0.023 J * 0.30 *
DELTA-BHC ND 0.00069 NJ *
ENDOSULFAN I ND 0.0024 J
INORGANICS (MG/KG)
ALUMINUM 5350 8890 J
BARIUM 7.7 J 17.1
BERYLLIUM ND 0.30 J
CADMIUM 2.8 20.2
CHROMIUM 1610 774
COBALT ND 3
COPPER 23.8 102
LEAD 146 346
MANGANESE 15 44.9
MERCURY 0.43 J 0.26
SELENIUM ND 1.6 J
SILVER ND 2 J
VANADIUM 20.9 J 18.4
ZINC 31.8 468
41M6406 19951115 19970903 20010801
SEMIVOLATILES (MG/KG)
BIS(2-ETHYLHEXYL)PHTHALATE ND 3.9 * 1.3 J *
CARBAZOLE ND 0.80 J NA
DIBENZOFURAN ND 0.35 J ND
PESTICIDES/PCBs (MG/KG)
4,4'-DDD 0.03 * 0.053 * 0.10 J *
4,4'-DDE 0.016 J * 0.044 * 0.03 J *
4,4'-DDT 0.0014 J * 0.019 * ND
ALDRIN 0.0017 J * ND ND
AROCLOR-1254 0.056 * ND ND
AROCLOR-1260 ND 0.18 * ND
DELTA-BHC ND 0.00094 NJ * 0.0021 J *
ENDOSULFAN I ND 0.0013 J ND
GAMMA-CHLORDANE 0.00081 J * ND ND
INORGANICS (MG/KG)
ALUMINUM 2410 J 8900 J 3000
BARIUM 4.3 J 15.2 7.5
BERYLLIUM 0.11 J 0.34 0.21 J
CADMIUM 8.8 21 8.6
CHROMIUM 324 868 370
COBALT 0.91 J 2.7 1.2 J
COPPER 29.4 J 115 58
LEAD 156 J 339 150
MANGANESE 15.2 48.8 30
MERCURY 0.12 J 0.25 0.12
SELENIUM 0.34 J 1.3 J ND
SILVER 0.37 J 1.9 J 1.3 J
VANADIUM 4.3 17.3 10
ZINC 105 J 330 140
400 0 400 Feet
NAVFAC
Naval Facilities Engineering Command
Figure 2-8
Wetland 64
COCs in Sediment
Site 41 Feasibility Study Report
NAS Pensacola
Pensacola, Florida
LEGEND
Sample Location
Road
Wetland
Building
Water
HHRA AOC
Ecological AOC
NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 64 considered a saltwater wetland
TETRA TECH
Drawn By: K. MOORE 7/22/09
Checked By: N. ROCHNA 7/23/09
Approved By:
Contract Number: 112G00390
CTO 030
P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 64 TAG LAYOUT 7/23/09 KM

# 3.0 SCREENING OF REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS

The following section identifies, screens, and evaluates the potential remediation technologies and process options that may be applicable for use in assembling remedial alternatives for sediment within Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64. The primary objective of Section 3.0 of the FS is to develop an appropriate range of remedial technologies and process options to be used for developing remedial alternatives.

The basis for remediation technology identification and screening began in Section 2.0 with a series of discussions that included the following:

- Identification of ARARs
- Development of RAOs
- Identification of GRAs
- Identification of volumes or areas of media of concern

Remediation technology screening is performed in this section with the completion of the following analytical steps:

- Identification and screening of remediation technologies and process options
- Evaluation and selection of representative process options

Within Section 3.0, a variety of remediation technologies and process options are identified for each of the GRAs listed in Section 2.3.1 and then screened. The selection of remediation technologies and process options for initial screening is based on the Guidance for Conducting Remedial Investigations/Feasibility Studies under CERCLA (USEPA, 1988). The screening is first conducted at a preliminary level to focus on relevant remediation technologies and process options, and then the screening is conducted at a more detailed level based on certain evaluation criteria. Finally, process options are selected to represent the remediation technologies that have passed the detailed evaluation and screening.

The evaluation criteria for detailed screening of remediation technologies and process options that have been retained after the preliminary screening are effectiveness, implementability, and cost. The following are descriptions of these evaluation criteria:

Effectiveness

Effectiveness is evaluated based on the following criteria:

- Ability of the technology to address the estimated areas or volumes of the contaminated media.
- Ability of the technology to meet the RAOs.
- Technical reliability (innovative versus well proven) with respect to contaminants and site conditions.
- Potential impacts to human health and the environment during implementation.

Implementability

Implementability is evaluated based on the following criteria:

- Overall technical feasibility at the site
- Availability of vendors, mobile units, storage and disposal services, etc
- Administrative feasibility
- Special long-term operation and maintenance (O&M) requirements

Cost

Cost is evaluated based on the following criteria:

- Capital cost
- O&M costs

Technologies and process options are identified in the following sections.

## 3.1 PRELIMINARY SCREENING OF SEDIMENT REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS

The following identifies and screens remediation technologies and process options for sediment at a preliminary stage based on implementation with respect to site conditions and COCs. The table below summarizes the preliminary screening of technologies and process options applicable to sediment. It presents the GRAs, identifies the technologies and process options, and provides a brief description of each process option followed by screening comments.

The following are the sediment remediation technologies and process options retained for detailed screening based on the results of preliminary screening.

| General Response Action | Remediation Technology | Process Option |
|---|---|---|
| No Action | None | Not Applicable |
| Limited Action | LUCs | Institutional Controls |
| | | Engineered Controls |
| | Monitoring | Sampling and Analysis |
| | Natural Recovery | Biodegradation, Dilution, Dispersion |
| Containment | Physical Capping | Sediment Cover |
| | Reactive Media Cover | Reactive Core Mat |
| Removal | Bulk Excavation | Dredging |
| In-Situ Treatment | Enhanced Natural Recovery | Thin-Layer Placement |
| | Biological | Phytoremediation |
| | Chemical/Physical | Stabilization/Solidification |
| Disposal | Landfill | Off-site Landfilling |

## 3.2 DETAILED SCREENING OF SEDIMENT REMEDIATION TECHNOLOGIES AND PROCESS OPTIONS

### 3.2.1 No Action

No Action consists of maintaining the status quo at the site. As required under CERCLA regulations, the No Action alternative is carried through the FS to provide a baseline for comparison with other alternatives and their effectiveness in mitigating risks posed by site contaminants. Because no remedial actions would be conducted under this alternative, there are no costs associated with “walking away” from the site. There would also not be any reduction in risk through exposure control or treatment. No Action would not be effective in evaluating contaminant mobility and potential migration off site because no monitoring would be performed.

Effectiveness

No Action would not be effective in meeting the sediment RAOs. Evaluation of reductions in sediment COC concentrations through natural recovery or the potential for migration of COCs off site or to another medium could not be achieved because no monitoring would be performed. Human health and ecological risk evaluation through this response action would not be possible.

Implementability

There would be no implementability concerns because no action would be implemented.

Cost

There would be no costs associated with No Action.

Conclusion

Because of NCP requirements, No Action is retained for all of wetlands, although it would not be effective.

### 3.2.2 Limited Action

The technologies considered under this GRA include LUCs, monitoring, and natural recovery.

#### 3.2.2.1 LUCs

LUCs are designed to protect public health and the environment from residual contamination at environmental sites. LUCs consist of administrative or legal mechanisms (e.g., deed or zoning restrictions, permits, etc.) designated as institutional controls and/or physical controls (e.g., fencing, security guards, etc.) designated as engineering controls. Site-specific LUCs are typically formulated through a LUC Remedial Design (RD) that is prepared in accordance with the Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions (DoD, 2004) following approval of the ROD. LUCs typically also include the performance of regular site inspection to verify continued implementation.

For wetland sediments, LUCs would consist of institutional controls, in which sediment access and future land use would be limited or restricted. Additional land use restrictions could include posting of “no trespassing” and “no fishing” signs where potential human health risks may exist. Also included as part of the LUCs, regular site inspections would be performed to verify continued implementation.

Effectiveness

LUCs consisting of site use and site access restrictions would effectively minimize unacceptable risks from direct exposure of human receptors to contaminated sediment. LUCs alone would not be effective at meeting RAOs pertaining to ecological receptors.

Implementability

LUCs would be easy to implement on a military facility where access is already restricted. A LUC RD could be readily prepared. LUCs for NAS Pensacola could easily be integrated and implemented.

Cost

The capital and O&M costs for LUCs would be low.

Conclusion

LUCs are retained for the development of sediment remedial alternatives, specifically to minimize human health risks.

#### 3.2.2.2 Monitoring

Monitoring would consist of sampling and analyzing sediment throughout the areas of sediment contamination to evaluate the potential for migration of sediment COCs either off site or to another medium, particularly surface water.

Effectiveness

Monitoring alone would not reduce the toxicity, mobility, or volume of contaminants in sediment. However, monitoring would allow for a determination of potential off-site migration of COCs or contaminant reduction through natural recovery. Human health and ecological risk evaluation through monitoring would be possible.

Implementability

Monitoring would be easy to implement. Such monitoring has been performed on several occasions at NAS Pensacola. The resources and material required for monitoring are readily available.

Cost

The capital and O&M costs of monitoring would be low.

Conclusion

Monitoring is retained for the development of sediment remedial alternatives.

#### 3.2.2.3 Natural Recovery

Natural recovery would consist of allowing naturally occurring processes to reduce the risks posed by sediment COCs over time. Natural recovery could involve physical processes (sedimentation, advection, dilution, dispersion, bioturbation, or volatilization), biological processes (biodegradation, biotransformation, or phytoremediation), or chemical processes (natural oxidation/reduction or sorption). To evaluate natural recovery, sediment samples would be regularly collected and analyzed to establish trends in concentrations of COCs.

Effectiveness

Sufficient analytical data are not currently available to establish clear trends in the concentrations of sediment COCs at NAS Pensacola. The above-mentioned physical natural recovery processes may reduce the ecological and human health risks. Biological natural recovery processes could reduce the concentrations of organic sediment COCs because inorganic and organic COCs can be removed via various biological processes. Sorption may marginally act as a risk reduction mechanism within the relatively fine sediment present at NAS Pensacola, specifically if sedimentation is occurring. However, the anticipated quantity of sedimentation is not significant enough to prevent migration of sediment COCs to surface water. Natural oxidation/reduction may marginally impact the organic and inorganic COCs.

Implementability

Natural recovery would be easy to implement because it requires monitoring as its only action. As noted earlier, the resources and materials required for monitoring are readily available.

Cost

The capital and O&M costs for natural recovery would be low.

Conclusion

Natural recovery is retained for the development of sediment remedial alternatives.

### 3.2.3 Containment

The technologies considered under this GRA include physical and reactive media cover capping.

#### 3.2.3.1 Physical Capping

Physical capping could be utilized by installing a relatively impermeable cover system over the contaminated sediment to prevent direct exposure of ecological receptors. Capping could minimize sediment COC migration to surface water and off site. The cover system would typically consist of a layer, at least 2 feet thick, of clean material with geotechnical characteristics (particle size, density, texture) such that it would be likely to remain above the contaminated sediment.

Effectiveness

Capping would not remove sediment COCs or reduce their toxicity. Nonetheless, capping is a well-established and proven technology that could be effective in preventing direct exposure of ecological receptors to contaminated sediment. A cap could be effective in minimizing the potential for off-site migration of sediment COCs, principally as a result of erosion and sedimentation.

Implementability

Installation of a cap over contaminated sediment is typically fairly easy to implement, and the required material and services are readily available. However, sediment capping would likely pose a significant detriment to species within the benthic zone.

Cost

The capital costs for physical capping would be moderate. Because of the need for frequent and long-term monitoring and maintenance, O&M costs would be relatively high.

Conclusion

Due to significant concerns regarding damage to the existing wetland ecology, continued contaminant mobility, and O&M costs, physical capping is eliminated for the development of sediment remedial alternatives.

#### 3.2.3.2 Reactive Media Cover

Implementation of a reactive media cover would consist of installing a reactive core mat (RCM) composed of reactive media “sandwiched” between two permeable layers of geotextile and non-woven composite material. The cover system typically consists of a RCM installed directly above the area of concern. A second layer of permeable geotextile with a higher density (usually sand filled) is then installed above the reactive layer to ensure placement of the reactive media. Reactive material within the RCM contains contaminant-specific treatment media such as organoclay, activated carbon, zero-valent iron, or apatite. Depending on the design of the composite material, the reactive media can treat or sequester contaminants via various physical, chemical, and biological mechanisms.

Effectiveness

Although a relatively new technology, reactive media covers have been successfully implemented for COCs such as the ones present in site sediment. A reactive media cover could prevent flux of sediment COCs into surface water. In addition, a RCM can also act as a substrate to encourage biological degradation. However, biological growth on the RCM is not normally favorable, because biological fouling may limit media effectiveness and require routine RCM replacement.

Implementability

Installation of a RCM over contaminated sediment is typically fairly easy to implement. Although few vendors provide materials and support RCM technology, the required materials and services can be readily acquired. Depending on the biological and contaminant loading on the cover, routine maintenance of the cover may be required, and replacement of the RCM may be warranted if the media become spent or fouled.

Cost

The capital costs for implementation of a reactive media cover would be moderate to high depending on the desired media within the cover. Because of the need for long-term monitoring and maintenance, O&M costs could potentially be high.

Conclusion

Due to implementability and O&M concerns, reactive media covers are eliminated for the development of sediment remedial alternatives.

### 3.2.4 Removal

The only technology considered under this GRA is bulk excavation and dredging. The three dredging methods considered for sediment removal include mechanical, hydraulic, and pneumatic processes.

#### 3.2.4.1 Long-Reach Backhoe

Most sediment would be accessible to excavation through use of a long-reach backhoe. Due to the nature of wetlands, load-bearing mats would be placed in the pathway of the backhoe for access to the wetland. Similarly, the mats would be placed in the excavation areas upon which the backhoe would be located during remedial activities.

Backhoes are typically used to remove small volumes of sediment and may result in potential loss of sediment due to an open excavator bucket. However, backhoes can be more effective than dredging systems for removing dense or hard material and for dredging of shallow sediment along shorelines.

#### 3.2.4.2 Mechanical Dredging

Mechanical dredging uses either normal excavation equipment (e.g., backhoe or Gradall) if it can reach the sediment depth or digging buckets (e.g., clamshell buckets) or dragline buckets suspended by a cable from a crane. This equipment can operate from shore or from a floating platform. Dragline buckets are used with a crane and are similar to digging buckets, with the difference that dragline buckets are open on one side and are lowered into the sediment with a lifting cable then pulled back towards the crane with a second cable.

Mechanical dredging typically removes subaqueous sediment at nearly the in-place density and water content. However, some water is added to the collected sediment because every bucket cannot be filled completely with sediment. Mechanical dredging typically adds a volume of water 20 to 50 percent of the bucket capacity. On-site dewatering of excavated sediment is common.

#### 3.2.4.3 Hydraulic Dredging

Hydraulic dredges are routinely used to move large sediment volumes. A typical hydraulic dredge consists of a suction head that collects the sediment as a slurry. The suction head is connected to a hydraulic pump that aspirates the sediment slurry and conveys it to the desired location for further processing. The machinery may also be equipped with rotating cutting tools or augers to enhance sediment removal. Hydraulic dredges typically use a volume of water 5 to 10 times that of the in-place sediment to be removed to create and transport the sediment slurry. The cutter or auger head hydraulic dredge is most commonly used to remove sediment and can effectively remove a wide variety of sediment types, including dense sand and hard clay. Hydraulic dredges that do not use a cutter or auger head can normally only remove relatively soft sediment with little debris. These hydraulic dredges often include water jets to help loosen and slurry the sediment.

#### 3.2.4.4 Pneumatic Dredging

Pneumatic dredges are similar to hydraulic dredges, except that in place of a pump, they use a pressure gradient created with compressed air to lift and move dredged material. Pneumatic dredges are not common and are used primarily for small-scale cleanup of spilled contaminants and marine archaeology.

Effectiveness

Excavation by dredging is a well-established and demonstrated technology to remove a wide variety of sediment from aquatic environments. Excavation by dredging is effective at addressing any class of contaminant (i.e., organic or inorganic) because it physically and non-selectively removes impacted material. Thus, excavation by dredging may be an effective technology to remove contaminated sediment. However, long-term applicability is questionable, as removal efforts would be ineffective if the source of contamination continues to transport COCs into sediment media.

Implementability

Excavation by dredging is a well-proven technology that can be implemented readily at most sites. Dredging equipment and/or services are readily available from multiple vendors or contractors. During dredging, site-specific health and safety procedures and Occupational Safety and Health Act (OSHA) regulations would have to be complied with to ensure that the exposure of workers to COCs is minimized.

Cost

Dredging costs are typically low. However, post-removal sediment management and disposal costs can substantially increase the overall costs of a dredging removal action.

Conclusion

Because impacted sediment zones at Wetlands 5A, 15, 16, 18A, 18B, and 48, and 64 can be removed effectively and are accessible via excavation by mechanical dredging methods, mechanical dredging is retained as a remedial alternative.

### 3.2.5 In-Situ Treatment

The technologies considered under this GRA include enhanced natural recovery, phytoremediation, and chemical stabilization/solidification.

#### 3.2.5.1 Enhanced Natural Recovery

Enhanced natural recovery would consist of accelerating the previously discussed natural recovery processes (particularly biodegradation and sedimentation) through engineering means. The addition of a thin-layer of clean sediment is an effective engineering means of encouraging natural recovery via biodegradation and sedimentation. Appropriately, this option is commonly referred to as thin-layer placement.

Effectiveness

Compared to natural recovery without enhancement, thin-layer placement could accelerate the biodegradation of organic COCs in sediment by providing an appropriate support medium for biological activity. Conversely, thin-layer placement is not anticipated to affect the removal of inorganic COCs. In addition, it is likely that thin-layer placement would address predominantly the upper layer of contaminated sediment, but the deeper layers would remain essentially unaffected. Thin-layer placement may enhance natural recovery through sedimentation by increasing the thickness of clean material. However, this effect would be minimal because the typical thickness of material involved in thin-layer placement (6 inches or less) would not by itself result in adequate risk reduction for human or ecological receptors.

Implementability

The implementability of enhanced natural recovery through thin-layer placement is typically fairly easy. Accurate placement of a fairly thin layer of sand or similar material would be easy to achieve, and the layer would be relatively easy to maintain over the long term.

Cost

The capital and O&M costs for enhanced natural recovery through thin-layer placement would be moderate.

Conclusion

Enhanced natural recovery via thin-layer placement is eliminated from further consideration because of effectiveness concerns.

#### 3.2.5.2 Phytoremediation

Phytoremediation involves the use of plants to reduce hazardous organic and inorganic contaminants to non-toxic or less toxic concentration levels. Phytoremediation is most applicable in large areas with low to moderate contaminant levels. The remedial technology may be utilized in sediment to process COCs through one or more of the mechanisms:

- Phytoextraction – root uptake or translocation of contaminants within plants. Plant harvesting is generally required for contaminant removal. Demonstrated mechanism for cadmium, cobalt, chromium, mercury, manganese, arsenic and zinc.

- Phytostabilization – immobilization of a contaminant via root absorption, adsorption, accumulation, or precipitation or the utilization of plants to prevent contaminant migration. Demonstrated mechanism for arsenic, cadmium, chromium, arsenic, and zinc.

- Rhizodegradation – microbial breakdown of contaminants in sediment within the root zone of plants. Demonstrated mechanism for PAHs, total petroleum hydrocarbons (TPH), pesticides, chlorinated solvents, and PCBs.

- Phytodegradation – metabolic breakdown of contaminants by plants or the external breakdown of contaminants from compounds produced by plants. Demonstrated mechanism for organic compounds, chlorinated solvents, phenols, and herbicides.

- Phytovolatilization – contaminant uptake and transpiration by a plant to the atmosphere. Demonstrated mechanism for chlorinated solvents and several inorganics (e.g. selenium, mercury, and arsenic).

Phytoremediation may utilize various species of plants depending on the required mechanism and COCs. A treatability study would be required to verify species selection and quantify removal efficiency for specific COCs. If thereafter found applicable, native or introduced species would be planted in the areas of sediment contamination. If non-native plants are utilized, appropriate control techniques would be used to verify that genetic contamination or invasive spread does not occur. If native species are selected, the remediation potential of existing plants should be carefully assessed.

An array of the above mechanisms may be implemented for COC removal and containment. Sediment samples would be regularly collected and analyzed to evaluate the progress of remediation.

<u>Effectiveness</u>

The effectiveness of phytoremediation is documented in many cases for the in-situ removal or containment of inorganic and organic contaminants such as the Sit 41 COCs. A combination of several mechanisms may be utilized to incorporate the variety of COCs requiring remedial action. Treatability testing would be required to evaluate the site-specific applicability of phytoremediation. Successful application of phytoremediation could achieve RAOs and reduce human and ecological risks. However, plant toxicology and organisms within the herbivorous food chain should be evaluated in detail prior to application to ensure that implementation does not create adverse affects.

Implementability

Phytoremediation of contaminated sediment would be relatively easy to implement at NAS Pensacola. Planting of selected species would be relatively unobtrusive with respect to existing biota.

Cost

The capital and O&M costs for phytoremediation would be low.

Conclusion

Sediment COC concentrations greater than PRGs are limited to the top 6-inches of sediment. Therefore, phytoremediation is not retained as a GRA due to concerns with effective plant root depths extending beyond the impacted depth.

#### 3.2.5.3 Chemical Stabilization/Solidification

Chemical stabilization would consist of mixing contaminated sediment with chemical reagents that modify COCs to render them less soluble and hence less mobile. Chemical solidification binds the COCs within the matrix of the material being treated. The most common stabilization reagents are phosphates, carbonates, hydroxides, and sulfates. Common solidification reagents include pozzolanic-based materials such as Portland cement, cement kiln dust (CKD), and fly ash. Other reagents such as thermoplastic binders (i.e., asphalt); sorbents such as granular activated carbon (GAC), clays, zeolites, and anhydrous sodium silicate; and MAECTITE® have also been successfully used for chemical stabilization/solidification.

For in-situ chemical stabilization/solidification, the above-mentioned chemical reagents are typically mixed with the contaminated sediment to be treated using specialized mechanical excavating and blending equipment that combines augering of the sediment with high-pressure injection of the reagents.

Effectiveness

Chemical stabilization/solidification is a well-established and proven technology, but its effectiveness is highly dependent on the type of material being treated and the type of COCs being immobilized. A physical and chemical characterization of the media and COCs to be immobilized and/or treated is needed. Treatability testing is typically required to determine the most suitable stabilization/solidification reagents and mixing ratios. The effectiveness of in-situ chemical stabilization/solidification could be limited by incomplete in-situ sediment/reagent blending, which is typically not as complete as in an ex-situ environment.

In-situ chemical stabilization/solidification would effectively minimize the potential for migration of COCs from sediment to other environmental media such as surface water. However, in-situ chemical stabilization/solidification does not eliminate the toxicity of COCs immobilized in the treated sediment and leaves this treated sediment in place. Long-term stability and leachability of the treated sediment would remain as potential concerns because COCs would remain within the treated sediment. These concerns are particularly valid for application of this technology to sediment within saltwater wetlands, where the high salinity of NAS Pensacola surface water could significantly impact the long-term stability of the stabilized sediment.

<u>Implementability</u>

In-situ chemical stabilization/solidification is typically fairly easy to implement, and qualified contractors are readily available to perform this work. Treatability tests would be required to determine the appropriate mix ratios prior to implementation. Implementation of this technology within saturated media may not be feasible or effective. Similarly, the areal extent of sediment that would require treatment may be cost prohibitive.

<u>Cost</u>

The O&M costs of stabilization/solidification would be high to moderate. Because application of this technology would be contracted as a service, there would be no capital costs.

<u>Conclusion</u>

In-situ chemical stabilization/solidification is eliminated from further consideration because of effectiveness and implementability concerns.

### 3.2.6 <u>Disposal</u>

The only technology considered under this GRA is off-site landfilling.

**Off-Site Landfilling**

Off-site landfilling would consist of transporting dredged sediment for burial at a permitted facility. Prior to landfilling, sediment with higher concentrations of COCs might require treatment by one or more ex-situ treatment technologies at an off-site treatment, storage, and disposal facility (TSDF). In addition, sediment that contains metals with Toxicity Characteristic Leaching Procedure (TCLP) extract concentrations greater than Resource Conservation and Recovery Act (RCRA) toxicity characteristic concentrations would be identified as hazardous and would have to be disposed at a hazardous waste TSDF. At the TSDF, sediment would undergo treatment to satisfy land disposal restrictions (LDRs) prior to secure landfilling. Based on currently available analytical data, it is unlikely that sediment would require treatment at an off-site TSDF or that sediment would be identified as hazardous.

Effectiveness

Landfilling would not permanently or irreversibly reduce the concentrations or toxicities of sediment COCs. However, although the CERCLA preference for treatment relegates landfilling to a less preferable option, this technology could be an effective disposal option for contaminated sediment. Landfills are only permitted to operate if they meet certain requirements of design and operation governing foundation, liner, leak detection, leachate collection and treatment, daily cover, post-closure inspections and monitoring, etc., which ensure the effectiveness of these facilities. The requirements of a hazardous waste TSDF are typically more stringent than those of a municipal solid waste landfill.

Implementability

Off-site landfilling would be easy to implement provided the excavation method is applicable. Permitted municipal solid waste and hazardous waste TSDFs are available for this purpose. In certain cases, disposal at either type of facility may require pretreatment, which would mainly include the removal of free liquids by dewatering to facilitate the transport of dredged sediment for disposal. A waste profile would have to be prepared, including indications of contaminant concentrations and their leachabilities. Adverse impact of the surrounding community and the environment from off-site transportation of contaminated sediment would be adequately mitigated by adherence to spill prevention procedures and by compliance with Department of Transportation (DOT) regulations.

Cost

The O&M cost of off-site disposal would be low to moderate for a municipal solid waste landfill, moderate for a non-hazardous waste TSDF, and high for a hazardous waste TSDF.

Conclusion

Landfilling is retained for the development of sediment remedial alternatives because removal of contaminated sediment was retained for Wetlands 5A, 15, 16, 18A, 18B, 48, and 64.

## 3.3 CONCLUSIONS

Table 3-1 presents a summary of GRA's retained for specific wetlands. These technologies are evaluated in detail for the applicable wetlands in Section 4.0.

TABLE 3-1

RETAINED GENERAL RESPONSE ACTION SUMMARY
SITE 41 FEASIBILITY STUDY REPORT
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

| General Response Action | Remediation Technology | Process Option | Wetland Location | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *3* | *5A* | *15* | *16* | *18A* | *18B* | *48* | *64* |
| No Action | None | Not Applicable | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Limited Action | LUCs | Institutional Controls | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | | Physical Controls | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Monitoring | Sampling and Analysis | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Natural Recovery | Biodegradation, Dilution, Dispersion | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Containment | Capping | Sediment Cover | | | | | | | | |
| | Reactive Media Cover | Reactive Core Mat | | | | | | | | |
| Removal | Bulk Excavation | Excavation | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| | | Mechanical Dredging | | | | | | | | ✔ |
| In-Situ Treatment | Enhanced Natural Recovery | Thin-Layer Placement | | | | | | | | |
| | Biological | Phytoremediation | | | | | | | | |
| | Chemical/Physical | Stabilization/Solidification | | | | | | | | |
| Disposal | Landfill | Offsite Landfilling | | ✔ | ✔ | | | ✔ | ✔ | ✔ |

✔ – Denotes retained GRA

# 4.0 ASSEMBLY AND DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

## 4.1 INTRODUCTION

This section presents an evaluation of each remedial alternative with respect to the criteria of the NCP (40 CFR Part 300). These criteria and the relative importance of these criteria are described in the following subsections.

### 4.1.1 Evaluation Criteria

In accordance with the NCP (40 CFR Part 300.430), the following nine criteria are used for the evaluation of remedial alternatives:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume through Treatment
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

#### 4.1.1.1 Overall Protection of Human Health and the Environment

Alternatives must be assessed for adequate protection of human health and the environment, in both the short and long term, from unacceptable risks posed by hazardous substances or contaminants present at the site by eliminating, reducing, or controlling exposure to levels exceeding cleanup goals. Overall protection draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

#### 4.1.1.2 Compliance with ARARs

Alternatives must be assessed to determine whether they attain ARARs under federal environmental laws and state environmental or facility siting laws. CERCLA Section 121(d) specifies in part that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site or a waiver must be obtained [see also 40 CFR 300.430(f)(1)(ii)(B)]. Grounds for invoking a waiver would depend on the following circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will attain the ARAR.
- Compliance will result if greater risk to human health and the environment.
- Compliance is technically impracticable from an engineering perspective.
- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach.
- A state requirement has not been consistently applied, or the state has not demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state.
- For Superfund-financed response actions only, an alternative that attains the ARAR will not provide a balance between the need for protection of human health and the environment at the site and the availability of Superfund monies to respond to other sites that may present a threat to human health and the environment.

ARARs include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or worker protection requirements. In addition, per 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (TBC guidance category).

#### 4.1.1.3 Long-Term Effectiveness and Permanence

Alternatives must be assessed for the long-term effectiveness and permanence they offer, along with the degree of certainty that the alternative will prove successful. Factors that will be considered as appropriate include the following:

- <u>Magnitude of Residual Risk</u> - Risk posed by untreated waste or treatment residuals at the conclusion of remedial activities. The characteristics of residuals should be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate.

- Adequacy and Reliability of Controls - Controls such as containment systems and LUCs that are necessary to manage treatment residuals and untreated waste must be shown to be reliable. In particular, the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative such as a cap, slurry wall, or treatment system; and the potential exposure pathways and risks posed if the remedial action needs replacement.

#### 4.1.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The degree to which the alternative employs recycling or treatment that reduces the toxicity, mobility, or volume will be assessed, including how treatment is used to address the principal threats posed by the site. Factors that will be considered, as appropriate, include the following:

- The treatment or recycling processes the alternative employs and the materials that they will treat.

- The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled.

- The degree of expected reduction in toxicity, mobility, or volume of waste due to treatment or recycling and the specification of which reduction(s) is occurring.

- The degree to which the treatment is irreversible.

- The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents.

- The degree to which treatment reduces the inherent hazards posed by principal threats at the site.

#### 4.1.1.5 Short-Term Effectiveness

The short-term impacts of the alternative will be assessed considering the following:

- Short-term risks that might be posed to the community during implementation.

- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures.

- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation.

- Time until protection is achieved.

#### 4.1.1.6 Implementability

The ease or difficulty of implementing the alternatives will be assessed by considering the following types of factors, as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.

- Administrative feasibility, including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions).

- Availability of services and materials, including the availability of adequate off-site treatment capacity, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

#### 4.1.1.7 Cost

Capital costs will include both direct and indirect costs. Annual O&M costs will be provided, and a net present value of the capital and O&M costs will also be provided. Typically, the cost estimate accuracy range is plus 50 percent to minus 30 percent.

#### 4.1.1.8 State Acceptance

The state’s concerns that must be assessed include the following:

- The state’s position and key concerns related to the preferred alternative and other alternatives
- State comments on ARARs or the proposed use of waivers

These concerns cannot be evaluated until the state has reviewed and commented on the FS. These concerns will be discussed, to the extent possible, in the Proposed Plan to be issued for public comment.

#### 4.1.1.9 Community Acceptance

This assessment consists of responses of the community to the Proposed Plan and includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. This assessment can be conducted after comments on the Proposed Plan are received from the public.

### 4.1.2 Relative Importance of Criteria

Among the nine criteria, the threshold criteria are considered to be:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs (excluding those that may be waived)

The threshold criteria must be satisfied for an alternative to be eligible for selection.

Among the remaining criteria, the following five criteria are considered to be the primary balancing criteria:

- Long-Term Effectiveness and Permanence
- Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment
- Short-Term Effectiveness
- Implementability
- Cost

The balancing criteria are used to weigh the relative merits of the alternatives.

The remaining two of the nine criteria: State Acceptance and Community Acceptance, are considered to be modifying criteria that must be considered during remedy selection. These last two criteria can be evaluated after the FS has been reviewed by the State of Florida and the Proposed Plan has been discussed at a public meeting, if required and requested, and opened to public comment. Therefore, this document addresses only seven of the nine criteria.

### 4.1.3 Selection of Remedy

The selection of a remedy is a two-step process. The first step consists of identification of a preferred alternative and presentation of the alternative in a Proposed Plan to the community for review and comment. The preferred alternative must meet the following criteria:

- Protection of human health and the environment.
- Compliance with ARARs unless a waiver is justified.
- Cost effectiveness in protecting human health and environment and in complying with ARARs.
- Utilization of permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

The second step consists of the review of public comments and determination by the Navy and USEPA, in consultation with the State of Florida, as to whether the preferred alternative continues to be the most appropriate remedial action for the site.

## 4.2 ASSEMBLY AND DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SEDIMENT

This section will develop the remedial alternatives for sediment at Site 41. Additional site-specific information and assumptions will be provided in this section to further explain the alternative development process.

The following alternatives for sediment remediation have been developed for all Site 41 Wetlands:

- Alternative SED-1: No Action
- Alternative SED-2: Land Use Restrictions/Institutional Controls (LUCs)
- Alternative SED-3: LUCs and Natural Recovery

An additional alternative has been included for Wetlands 5A, 15, 16, 18A, 18B, 48, and 64:

- Alternative SED-4a: Ex-Situ Treatment – Removal (Excavation) and Disposal
- Alternative SED-4b: Ex-Situ Treatment – Removal (Dredging) and Disposal; Wetland 64 Boat Dock Area

Alternative SED-4 was not considered for Wetland 3 because it is not directly exposed to Waters of the State, and the Site 1 Landfill is considered a continuing source of COCs for this wetland. Wetlands 16 and 18A are similar in nature to Wetland 3; however, they are located in a recreational area.

A description and detailed analysis of these alternatives are provided in the following sections.

### 4.2.1 Alternative Sed-1: No Action

#### 4.2.1.1 Description

The No Action alternative maintains the site as is. This alternative does not address the sediment contamination and is retained to provide a baseline for comparison to other alternatives. There would be no reduction in toxicity, mobility, or volume of the contaminants other than what would result from leaching, biodegradation, and other natural attenuating factors. The site would not be available for unrestricted use.

#### 4.2.1.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative SED-1 would not provide protection of human health and the environment. Under the current commercial/industrial land use, there could be unacceptable risks to human health and/or ecological receptors from direct exposure to contaminated sediment. Because no monitoring would be performed, potential fluctuations in COC concentrations would not be detected.

Compliance with ARARs and TBCs

Alternative SED-1 would not comply with chemical-specific ARARs or TBCs because no action would be taken to reduce contaminant concentrations. Compliance with location-specific ARARs would be purely incidental. Action-specific ARARs are not applicable to this alternative.

Long-Term Effectiveness and Permanence

Alternative SED-1 would have no long-term effectiveness and permanence because contaminated sediment would remain on site. Because there would be no LUCs to restrict the disturbance of sediment within the site boundaries, the potential would also exist for unacceptable risk to develop for human and/or ecological receptors. Because there would be no monitoring, potential COC concentration fluctuations would not be detected. Although COC concentrations might eventually decrease to PRGs through natural recovery, no monitoring would verify this.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative SED-1 would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs might occur through sedimentation, leaching, biodegradation, and other natural attenuating factors, but no monitoring would be performed to verify this.

Short-Term Effectiveness

Because no action would occur, implementation of Alternative SED-1 would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment. Alternative SED-1 would never achieve the RAOs and, although the PRGs might eventually be achieved through natural recovery, this would not be verified through monitoring.

Implementability

Because no action would occur, Alternative SED-1 would be readily implementable. The technical feasibility criteria, including constructability, operability, and reliability, are not applicable. Implementability of administrative measures is not applicable because no such measures would be taken.

Cost

There would be no current costs associated with the No Action alternative. However, No Action could result in the exposure of trespassers, workers, and ecological receptors to contaminants. No Action at this time would not restrict future land use options; however, the wetland status of these areas would limit future development.

### 4.2.2 Alternative SED-2: Land Use Restrictions/Institutional Controls (LUCs)

#### 4.2.2.1 Description

LUCs would consist of restrictions on land use to eliminate or reduce the potential for unacceptable human health risks as a result of exposure to contaminated sediment by restricting access to the wetlands.

Restrictions on land use would consist of preparing and implementing a Land Use Control Implementation Plan (LUCIP), including restrictions to prevent future access or development at the wetlands. Annual inspections of the site would be conducted to confirm compliance with LUC objectives, and an annual compliance certificate would be prepared and provided to USEPA and FDEP. Prior to any property conveyance, USEPA and FDEP would be notified.

The LUCs would be maintained for as long as they are required to prevent unacceptable exposure to contaminated sediment and/or to preserve the integrity of the selected remedy.

#### 4.2.2.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative SED-2 would be protective of human health. LUCs restricting access would be protective of human health by preventing unacceptable risks to trespassers and workers from direct exposure to contaminated sediment. LUCs would also prohibit fishing, which would prevent human exposure to fish tissue uptake. Alternative SED-2 would not be immediately protective of ecological receptors. Monitoring would not be conducted under SED-2 to evaluate natural recovery.

Compliance with ARARs and TBCs

Alternative SED-2 would comply with location- and action-specific ARARs. Chemical-specific ARARs might eventually be achieved through natural recovery; however, monitoring would not be performed to evaluate this.

Long-Term Effectiveness and Permanence

Alternative SED-2 would provide long-term effectiveness and permanence for human health receptors. Restricting access would prevent unacceptable risk from direct exposure of trespassers (including recreational fishermen) and workers.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative SED-2 would not reduce the toxicity, mobility, and volume of contaminants.

Short-Term Effectiveness

Implementation of Alternative SED-2 would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment.

Implementability

Alternative SED-2 would be easily implementable.

The administrative aspects of Alternative SED-2 would be relatively simple to implement. If site ownership changed, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions.

Cost

The estimated costs for Alternative SED-2 at each wetland are as follows:

| Wetland | Capital Cost | 30-Year NPW of O&M Cost | 30-Year NPW |
|---|---|---|---|
| **3** | $28,000 | $50,000 | $78,000 |
| **5A** | $25,000 | $50,000 | $75,000 |
| **15** | $23,000 | $50,000 | $73,000 |
| **16** | $23,000 | $50,000 | $73,000 |
| **18A** | $24,000 | $50,000 | $74,000 |
| **18B** | $22,000 | $50,000 | $72,000 |
| **48** | $28,000 | $50,000 | $78,000 |
| **64** | $35,000 | $50,000 | $85,000 |
| **Total** | **$208,000** | **$400,000** | **$608,000** |

The above cost figures have been rounded to the nearest $1,000 to reflect the preliminary nature of these estimates. A detailed breakdown of estimated costs for this alternative is provided in Appendix C.

### 4.2.3 Alternative SED-3: LUCs and Natural Recovery

#### 4.2.3.1 Description

Alternative SED-3 consists of two major components: (1) LUCs and (2) Natural Recovery.

Component 1: LUCs

This component would be the same as SED-2.

Component 2: Natural Recovery

During LUC implementation, natural processes such as leaching, biodegradation, and sedimentation (cover) would improve the quality of the sediment. Annual sediment sampling would be conducted at each wetland to evaluate natural recovery.

#### 4.2.3.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative SED-3 would be protective of human health and the environment.

LUCs would be protective as described for SED-2. Annual monitoring would provide data to evaluate the rate of natural recovery of each wetland. Ecological receptors would be protected over time through naturally occurring processes that would be monitored and documented.

<u>Compliance with ARARs and TBCs</u>

Alternative SED-3 would comply with location- and action-specific ARARs. Chemical-specific ARARs and TBCs would not immediately be achieved. However, natural recovery processes would be evaluated as part of this alternative.

<u>Long-Term Effectiveness and Permanence</u>

Alternative SED-3 would provide long-term effectiveness and permanence.

Restricting access would prevent unacceptable risk from direct exposure of trespassers (including recreational fishermen) and workers. Monitoring natural recovery processes would allow for evaluation of ecological risks over time.

<u>Reduction of Toxicity, Mobility, or Volume through Treatment</u>

Alternative SED-3 would not reduce the toxicity, mobility, and volume of contaminants.

<u>Short-Term Effectiveness</u>

Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site sampling activities. However, the potential for exposure would be minimized by the wearing of appropriate (PPE), and compliance with OSHA regulations and site-specific health and safety procedures.

Implementation of Alternative SED-3 would not result in short-term adverse impact to the local community and the environment.

<u>Implementability</u>

Alternative SED-3 would be easily implementable.

The administrative aspects of Alternative SED-3 would be relatively simple to implement. If property ownership changed, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions.

Cost

The estimated costs for Alternative SED-3 are as follows.

| Wetland | Capital Cost | 30-Year NPW of O&M Cost | 30-Year NPW |
|---|---|---|---|
| **3** | $28,000 | $121,000 | $149,000 |
| **5A** | $25,000 | $113,000 | $138,000 |
| **15** | $23,000 | $144,000 | $167,000 |
| **16** | $23,000 | $151,000 | $174,000 |
| **18A** | $24,000 | $148,000 | $172,000 |
| **18B** | $22,000 | $146,000 | $168,000 |
| **48** | $28,000 | $111,000 | $139,000 |
| **64** | $35,000 | $428,000 | $463,000 |
| **Total** | **$208,000** | **$1,362,000** | **$1,570,000** |

The above cost figures have been rounded to the nearest $1,000 to reflect the preliminary nature of these estimates. A detailed breakdown of estimated costs for this alternative is provided in Appendix C.

### 4.2.4 Alternative SED-4a: Ex-Situ Treatment - Excavation and Off-Site Disposal (Wetlands 5A, 15, 16, 18A, 18B, 48 and 64)

#### 4.2.4.1 Description

Alternative SED-4a consists of three major components: (1) excavation of contaminated sediment; (2) off-site sediment disposal; and (3) wetland reconstruction.

Component 1: Excavation

Sediment with concentrations of COCs greater than human health and ecological PRGs would be excavated to 1 foot bgs. The proposed excavation areas for each wetland are presented on Figures 4-1 through 4-7. The proposed excavation areas and volumes are as follows.

| Wetland | Area (square yards) | Volume (cubic yards) |
|---|---|---|
| **5A** | 5,400 | 1,800 |
| **15** | 5,550 | 1,850 |
| **16** | 1,600 | 530 |
| **18A** | 560 | 190 |
| **18B** | 625 | 210 |

| Wetland | Area (square yards) | Volume (cubic yards) |
|---|---|---|
| **48** | 22,080 | 7,360 |
| **64** | 102,220 | 34,100 |

Component 2: Off-Site Disposal

Although the general COC concentrations are considered ecological risks, all of the excavated sediment and cleared vegetation would be considered non-hazardous and could be disposed in a RCRA Subtitle D landfill. Samples of the vegetation and excavated sediment would be collected and analyzed to ensure that the waste materials comply with the landfill permit.

Component 3: Wetland Reconstruction

Removal of 1 foot of sediment from the areas of concern would be preceded by the stripping of vegetative cover from these areas. Wetland reconstruction would be necessary and would include the placement clean sand fill in the excavated areas. Plants matching the native species would be placed in the filled areas to return each wetland to pre-construction conditions.

#### 4.2.4.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative SED-4a would be protective of human health and the environment.

Excavation of sediment with COC concentrations greater than PRGs would eliminate or reduce the potential for unacceptable human health and ecological risks as a result of exposure to contaminated sediment.

Compliance with ARARs and TBCs

Alternative SED-4a would comply with all chemical-, location-, and action-specific ARARs and TBCs.

Long-Term Effectiveness and Permanence

Alternative SED-4a would provide long-term effectiveness and permanence.

Excavation of sediment with COC concentrations greater than would effectively and permanently prevent unacceptable risk from exposure to contaminants and migration to surface water

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative SED-4a would not reduce the toxicity, mobility, and volume of contaminants.

Short-Term Effectiveness

Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site remedial activities. However, the potential for exposure would be minimized by the implementation of engineering controls, wearing of appropriate PPE, and compliance with OSHA regulations and site-specific health and safety procedures. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.).

Alternative SED-4a could be completed in approximately 6 months and would achieve the RAOs and attain the sediment PRGs at completion.

Implementability

Alternative SED-4a would be fairly complicated to implement.

The excavation component of this alternative could be performed with specialized construction equipment, resources, and materials that would be available for this purpose. Because the excavation would be in wetland areas, dewatering and/or water flow diversion would be needed in some instances. Existing vegetation would need to be removed and restored after excavation. Because of the shallow excavation depth and nature of the wetlands, buried utilities may not be affected. Mats would be required to support excavation equipment.

Non-hazardous waste landfills for the off-site disposal of sediment and cleared vegetation would be readily available.

The administrative aspects of Alternative SED-4a would be moderately difficult to implement. Off-site transportation and disposal of the excavated sediment and vegetation would require the completion of administrative procedures, which could readily be accomplished. However, excavation and reconstruction of a wetland would require the involvement of the United States Army Corps of Engineers, FDEP, and USEPA to properly permit construction activities.

Cost

The estimated costs for Alternative SED-4a are as follows.

| Wetland | Capital Cost |
|---|---|
| **5A** | $1,176,000 |
| **15** | $1,167,000 |
| **16** | $570,000 |
| **18A** | $1,077,000 |
| **18B** | $428,000 |
| **48** | $2,763,000 |
| **64** | $10,207,000 |
| **Total** | $17,388,000 |

The above cost figures have been rounded to the nearest $1,000 to reflect the preliminary nature of these estimates. A detailed breakdown of estimated costs for this alternative is provided in Appendix C.

### 4.2.5 Alternative SED-4b: Ex-Situ Treatment - Dredging and Off-Site Disposal (Wetland 64)

#### 4.2.5.1 Description

Alternative SED-4b consists of two major components: (1) excavation of contaminated sediment and (2) off-site disposal sediment, and applies only to Wetland 64.

Component 1: Excavation

Sediment with concentrations of COCs greater than human health and ecological PRGs would be excavated via dredging to 1 foot bgs. The proposed dredging area for Wetland 64 is presented on Figure 4-7. An estimated area of 33,350 square yards will be dredged, resulting in a total sediment volume of 11,150 cubic yards being removed and disposed.

Because of the depth of water over the areas to be dredged (approximately 8 to 10 feet) and the dredge locations (around the boat dock area), the dredging would be performed using hydraulic dredging methods. A digital global positioning system (DGPS) would be used to control the limits of the submerged cutter head on the hydraulic dredging equipment. The dredged sediments removed from Wetland 64 would be hydraulically pumped to a processing or dewatering pad where the sediment would be pumped into geosynthetic filter bags (sediment bags) and allowed to dewater by gravity. The dewatering pad would need to be constructed to contain 11,150 cubic yards of wet sediments and the water expected to be generated through the hydraulic dredging process. Following the dewatering process, the removed sediment would be loaded into trucks and transported to an off-site landfill. Water removed from the sediment would be treated and discharged back to wetland. Based on the contaminants in the sediment requiring removal, it is expected that the water treatment would include pumping the water through a filtration unit and an activated carbon unit.

Component 2: Off-Site Disposal

Approximately 11,150 cubic yards (in-place volume) of sediment over a 33,350-square-foot area would be hydraulically dredged from Wetland 64. Based on similar dewatering and consolidation projects, it is estimated that the dredged sediment would consolidate approximately 20 percent over a 6- to 9-month dewatering period. Therefore, following one drying season (6 to 9 months), the expected volume to be disposed off site would be 80 percent of the in-place sediment volume (11,150 cubic yards). Additionally, the water generated through hydraulic dredging and dewatering would be expected to be equal to approximately 6 parts water to 1 part sediment. Therefore, through the dredging process and a 6- to 9-month drying period.

Although the general COC concentrations are considered ecological risks, all of the excavated sediment would be considered non-hazardous and could be disposed of in a RCRA Subtitle D landfill. Samples of the excavated sediment would be collected and analyzed to ensure that the waste materials comply with the landfill permit.

#### 4.2.5.2 Detailed Analysis

Overall Protection of Human Health and the Environment

Alternative SED-4b would be protective of human health and the environment.

Excavation of sediment with COC concentrations greater than PRGs would eliminate or reduce the potential for unacceptable human health and ecological risks as a result of exposure to contaminated sediment.

Compliance with ARARs and TBCs

Alternative SED-4b would comply with all chemical-, location-, and action-specific ARARs and TBCs.

Long-Term Effectiveness and Permanence

Alternative SED-4b would provide long-term effectiveness and permanence.

Excavation of sediment with COC concentrations greater than PRGs would effectively and permanently prevent unacceptable risk from exposure to contaminants in sediment and migration of contaminants to surface water.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative SED-4b would not reduce the toxicity, mobility, and volume of contaminants through excavation of sediment.

Short-Term Effectiveness

Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site remedial activities. However, the potential for exposure would be minimized by the implementation of engineering controls, wearing of appropriate PPE, and compliance with OSHA regulations and site-specific health and safety procedures. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.).

Alternative SED-4b could be completed in approximately 6 to 9 months and would achieve the RAOs and attain the sediment PRGs at completion.

Implementability

Alternative SED-4b would be fairly complicated to implement.

The dredging component of this alternative could be performed with specialized construction equipment, resources, and materials that would be available for this purpose. Because the excavation would be in the boat dock area, equipment movement would be quite difficult. A dewatering area would be required to allow the sediment to drain.

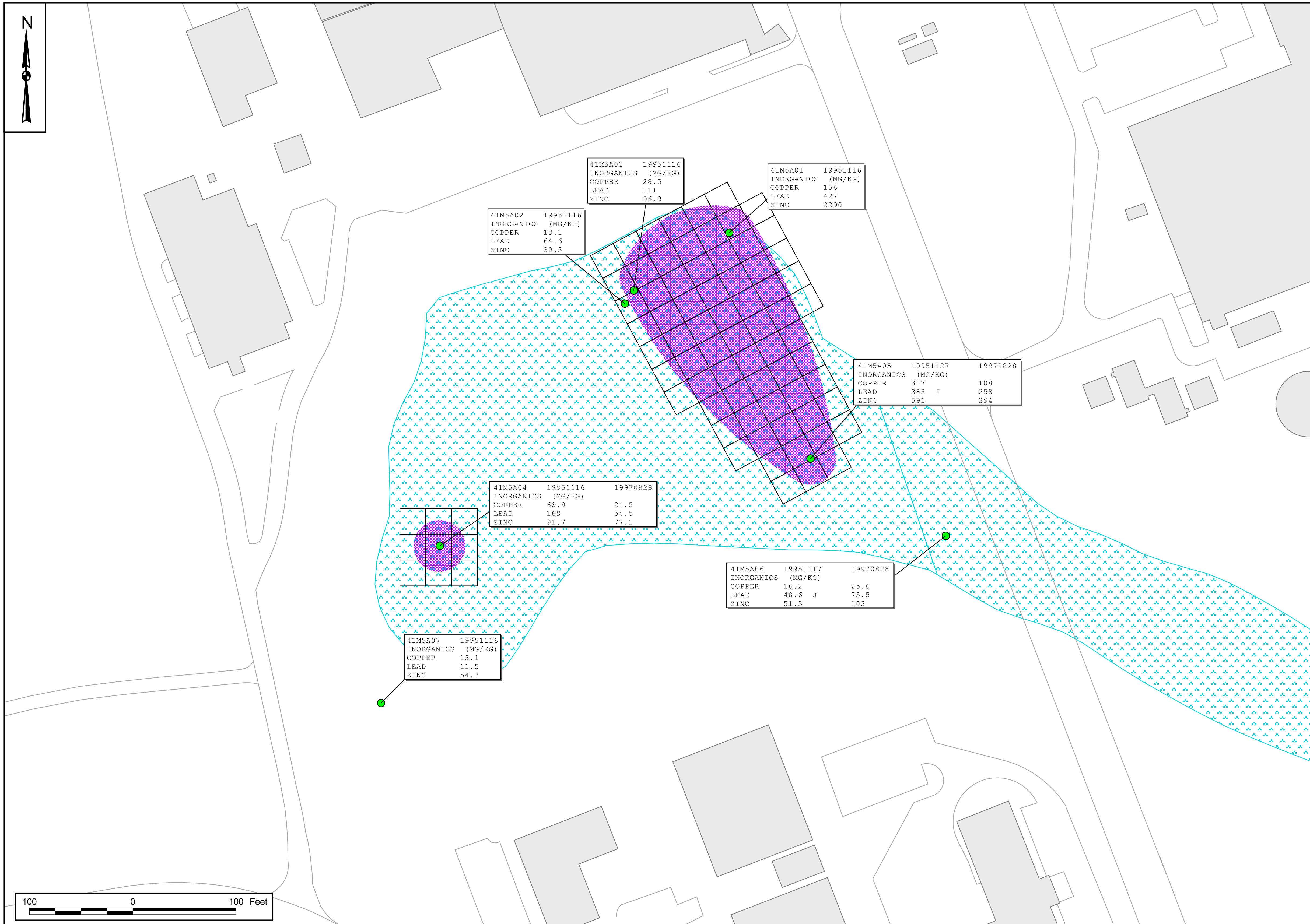
Non-hazardous waste landfills for the off-site disposal of sediment would be readily available.

The administrative aspects of Alternative SED-4a would be moderately difficult to implement. Off-site transportation and disposal of the excavated sediment would require the completion of administrative procedures, which could readily be accomplished. However, dredging would require the involvement of the United States Army Corps of Engineers, FDEP, and USEPA to properly permit construction activities. Special concerns are associated with the hydraulic dredging process. Hydraulic dredging requires the addition of polymers to the dredged sediment for pumping purposes. If the polymers and sediment bags are not compatible with one another, the sediment bags can clog and prevent the dewatering process. Settling basins can be used instead of sediment bags, but dewatering using settling basins takes significantly longer than with sediment bags because the sediment must fall through the water column rather than the water being filtered though the sediment bags. Additionally settling basins require the addition of flocculants to help speed up the settlement process. Due to the time associated with the dewatering process, this FS assumes the use of sediment bags rather than settling basins.

Cost

The estimated costs for Alternative SED-4b are included in the costs for Alternative SED-4a at Wetland 64. These two alternatives will be performed simultaneously at Wetland 64.

A detailed breakdown of estimated costs for this alternative is provided in Appendix C.




NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

Figure 4-1
Wetland 5A
Areas of Excavation
Site 41 Feasibility Study Report
NAS Pensacola
Pensacola, Florida

LEGEND
- Sample Location
- Road
- Wetland
- Building
- Ecological AOC
- 25-ft Excavation Grid

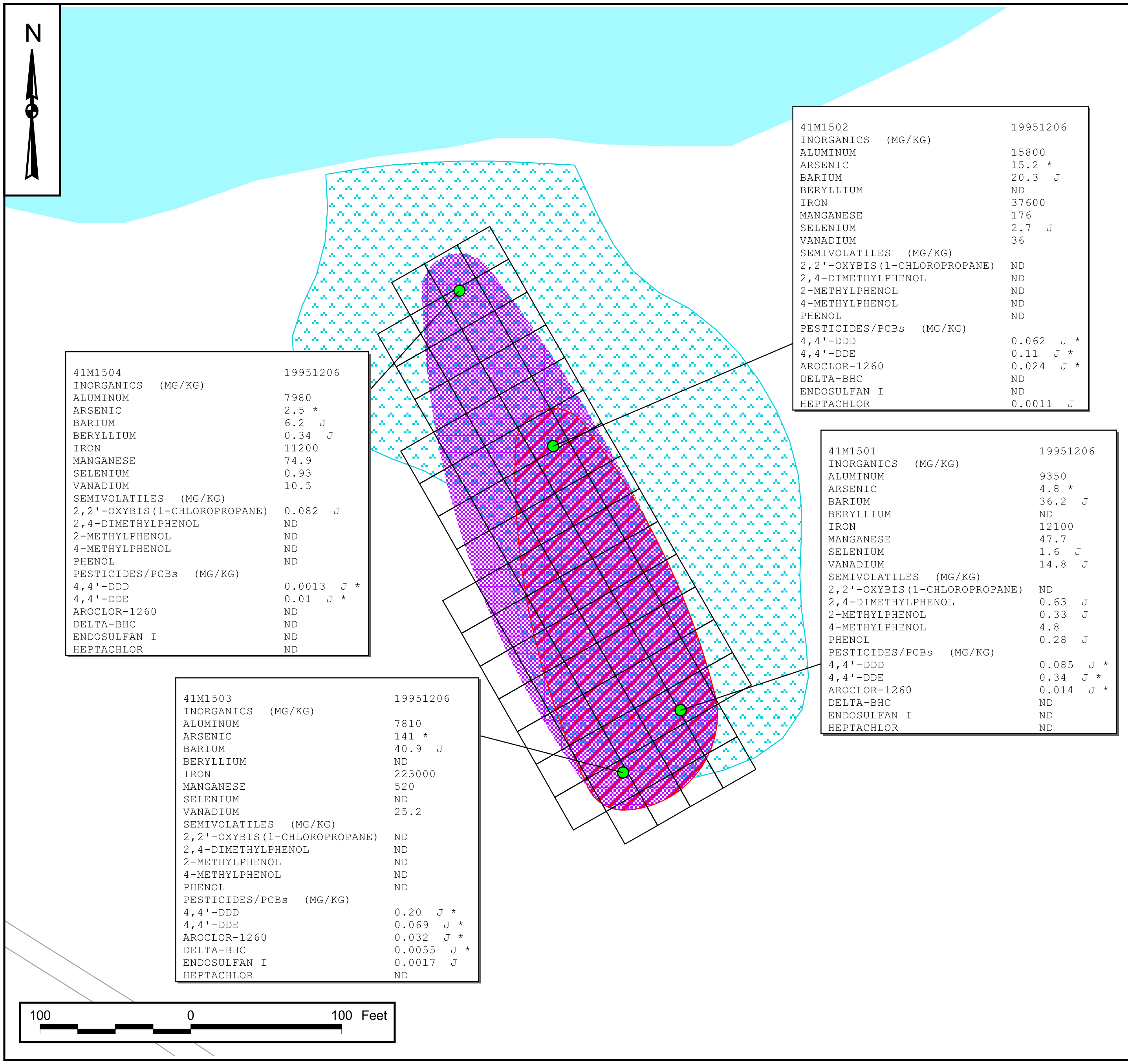
TETRA TECH

NOTES:
1. J - estimated value
2. Wetland 5A is considered a freshwater wetland

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/23/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 5A SD AOC EXCAVATION LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

# Figure 4-2
# Wetland 15
# Area of Excavation
# Site 41 Feasibility
# Study Report
# NAS Pensacola
# Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Water
- HHRA AOC
- Ecological AOC
- 25-ft Excavation Grid

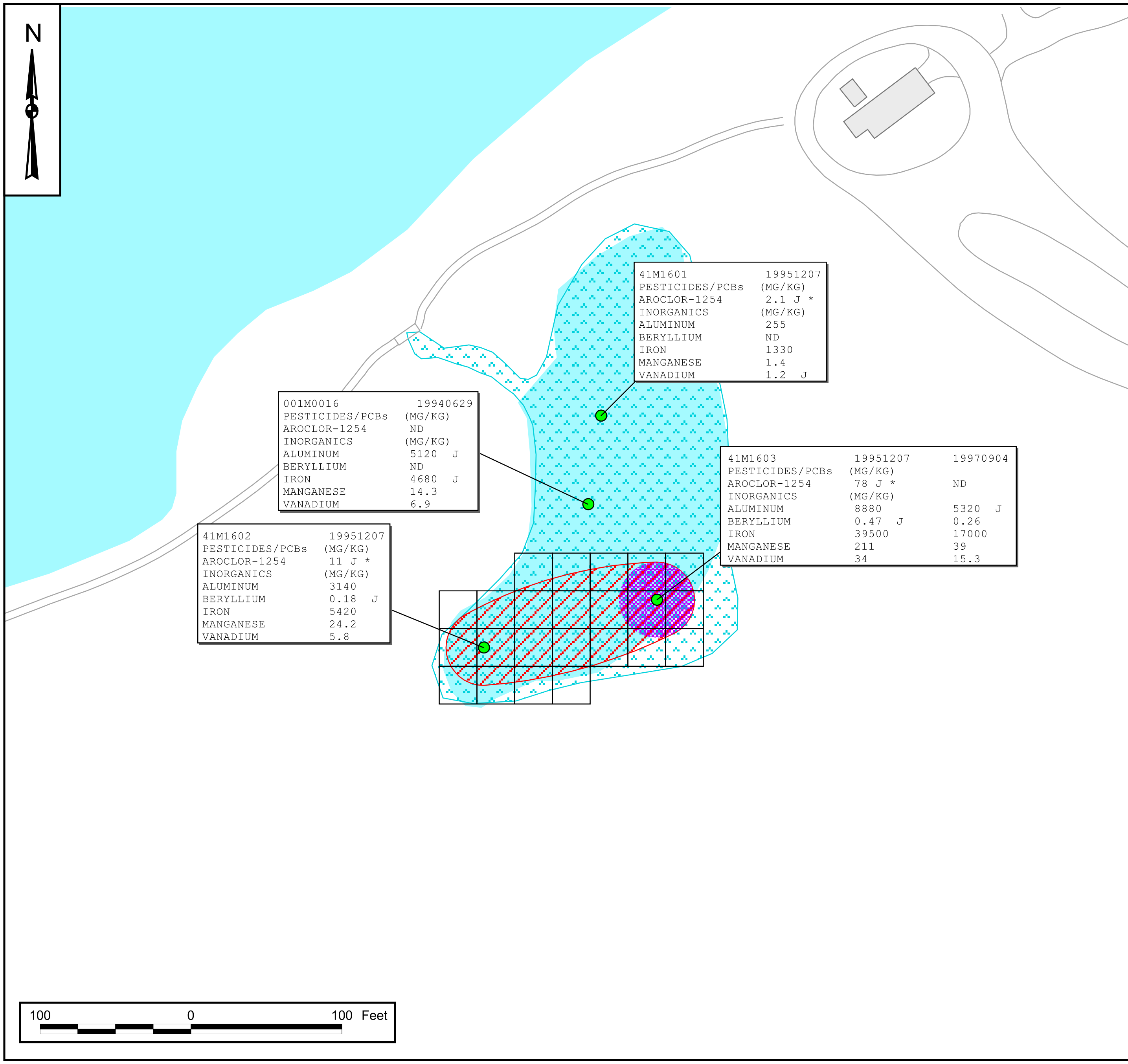
NOTES:
1. J - estimated value
2. * HHRA COC
3. Wetland 15 is considered a saltwater wetland

TETRA TECH

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/23/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 15 SD AOC EXCAVATION LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command
NAVFAC WASHINGTON

# Figure 4-3
# Wetland 16
# Area of Excavation
# Site 41 Feasibility Study Report
# NAS Pensacola
# Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- Water
- HHRA AOC
- Ecological AOC
- 25-ft Excavation Grid

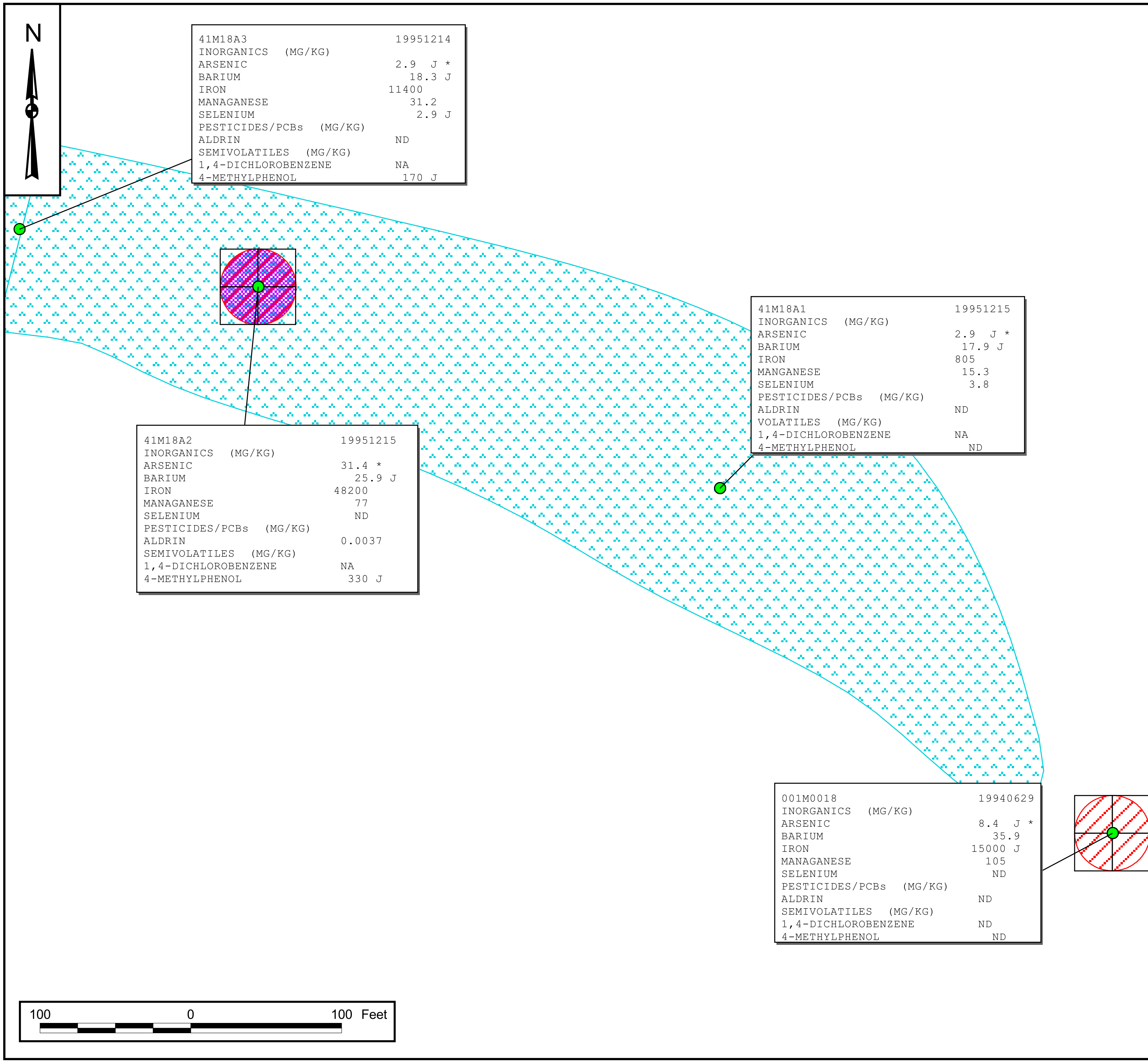
NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 16 is considered a saltwater wetland

TETRA TECH

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/23/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 16 SD AOC EXCAVATION LAYOUT 7/23/09 KM




NAVFAC Naval Facilities Engineering Command NAVFAC WASHINGTON

Figure 4-4
Wetland 18A
Area of Excavation
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Wetland
- HHRA AOC
- Ecological AOC
- 25-ft Excavation Grid

NOTES:
1. J - estimated value
2. * HHRA COCs
3. Wetland 18A is considered a freshwater wetland

TETRA TECH

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS
WETLANDS 18A SD AOC EXCAVATION LAYOUT 7/30/09 KM

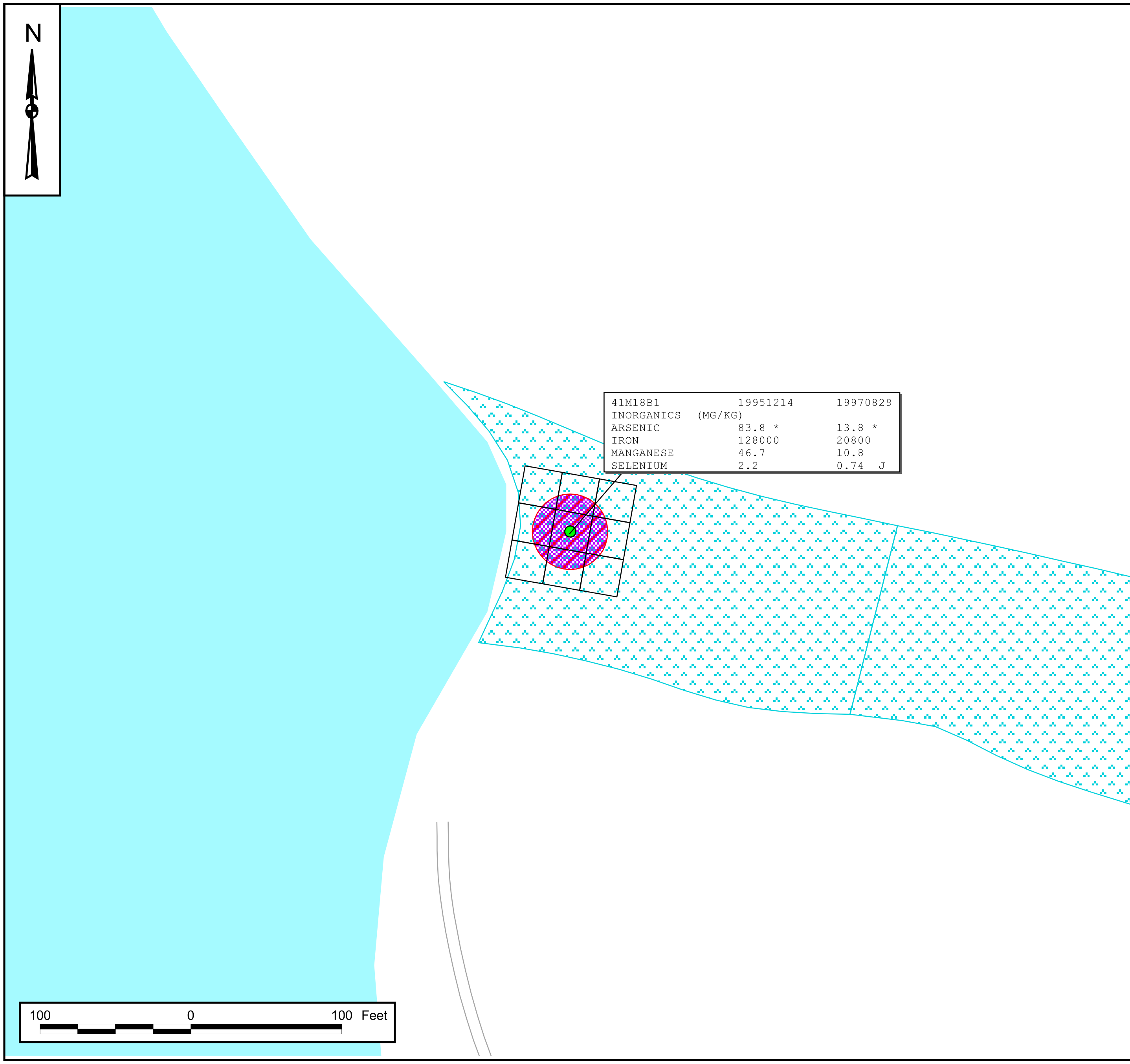



Figure 4-5
Wetland 18B
Area of Excavation
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- Water
- HHRA AOC
- Ecological AOC
- 25-ft Excavation Grid

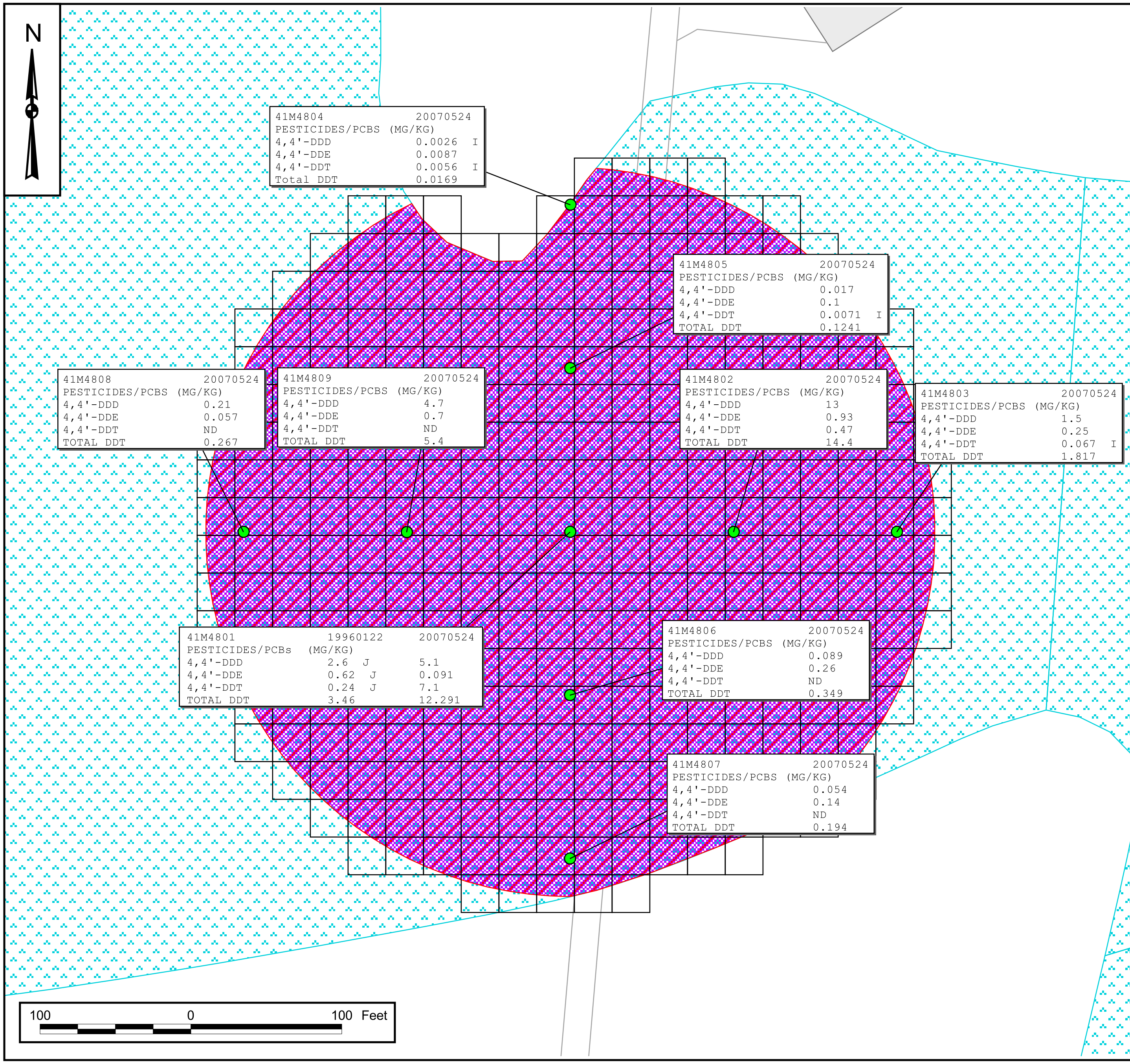
TETRA TECH

NOTES:
1. * HHRA COCs
2. Wetland 18B is considered
   a saltwater wetland

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/23/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 18B SD AOC EXCAVATION LAYOUT 7/23/09 KM




NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

Figure 4-6
Wetland 48
Area of Excavation
Site 41 Feasibility
Study Report
NAS Pensacola
Pensacola, Florida

LEGEND

- Sample Location
- Road
- Wetland
- Building
- HHRA AOC
- Ecological AOC
- 25-ft Excavation Grid

TETRA TECH

NOTES:
1. * HHRA COCs
2. Wetland 48 is considered a freshwater wetland

Drawn By: K. MOORE 7/23/09
Checked By: N. ROCHNA 7/30/09
Approved By:

Contract Number: 112G00390
CTO 030

P:\GIS\PENSACOLA_NAS\MAPDOCS\APR\WETLAND_TAGS.APR
WETLANDS 48 SD AOC EXCAVATION LAYOUT 7/30/09 KM

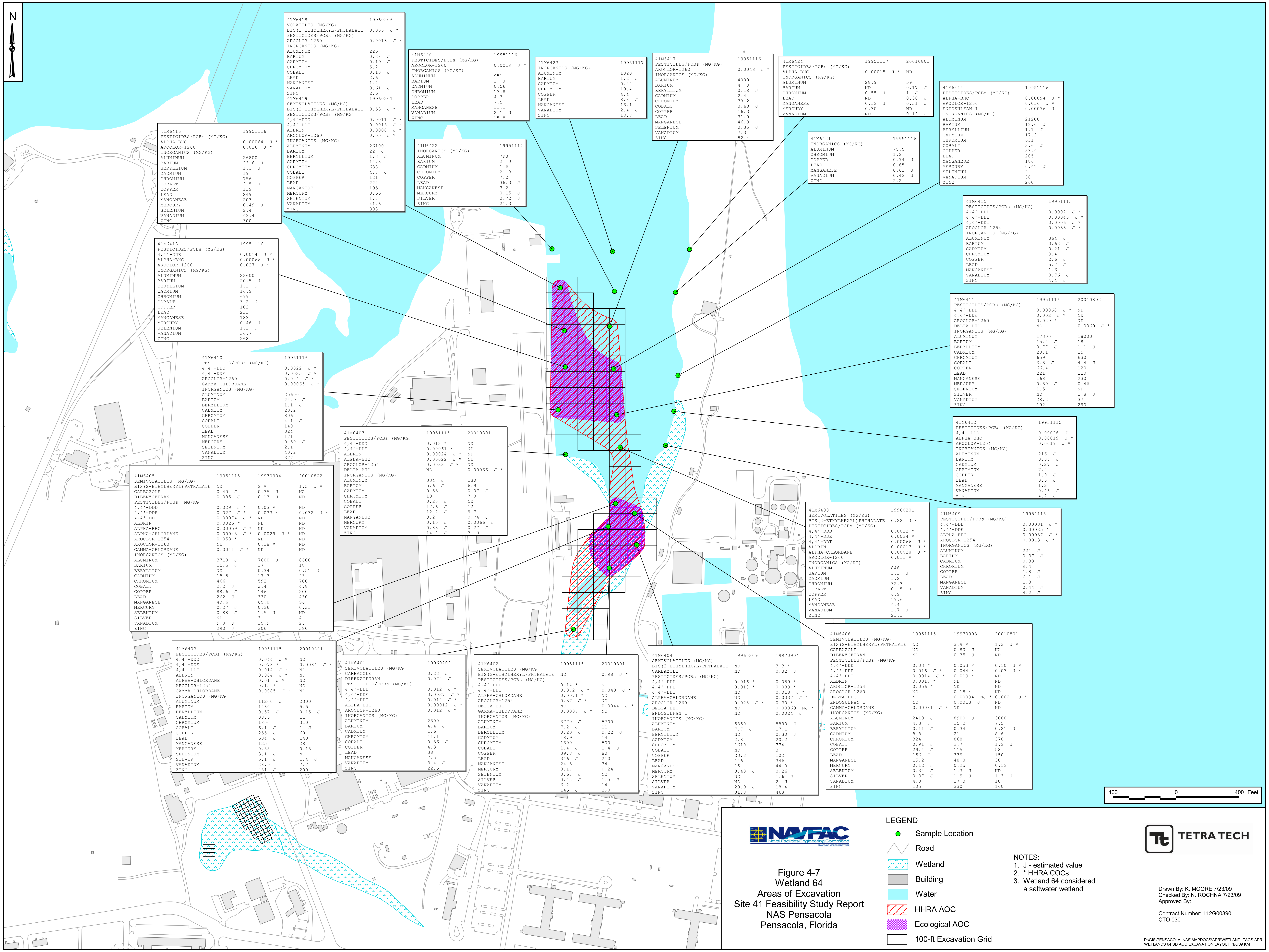



Figure 4-7
Wetland 64
Areas of Excavation
Site 41 Feasibility Study Report
NAS Pensacola
Pensacola, Florida

# 5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the analyses for each of the remedial alternatives presented in Section 4.0 of this FS. The criteria for comparison are identical to those used for the detailed analysis of individual alternatives.

## 5.1 COMPARISON OF SEDIMENT REMEDIAL ALTERNATIVES BY CRITERIA

The following alternatives for sediment remediation have been developed for Wetlands 3, 5A, 15, 16, 18A, 18B, 48, and 64:

- Alternative SED-1: No Action
- Alternative SED-2: Land Use Restrictions/Institutional Controls
- Alternative SED-3: LUCs and Natural Recovery

An additional alternative has been included for Wetlands 5A, 15, 16, 18A, 18B, 48, and 64:

- Alternative SED-4a: Ex-Situ Treatment - Removal (Excavation) and Disposal
- Alternative SED-4b: Ex-Situ Treatment - Removal (Dredging) and Disposal, Wetland 64 Boat Dock Area

### 5.1.1 Overall Protection of Health and Environment

Alternative SED-1 would not provide protection of human health and the environment. Under the current commercial/industrial land use, there could be unacceptable risks to human health and/or ecological receptors from direct exposure to contaminated sediment. Because no monitoring would be performed, potential fluctuations in COC concentrations would not be detected.

Alternatives SED-2 and SED-3 would be protective of human health. LUCs restricting access would be protective of human health by preventing unacceptable risks to trespassers and workers from direct exposure to contaminated sediment. LUCs would also prohibit fishing, which would prevent human exposure to potentially contaminated fish tissue. Alternatives SED-2 and SED-3 would not be immediately protective of ecological receptors. However, natural processes could eventually reduce COC concentrations in wetland sediment to the PRGs. Alternative SED-3 would be slightly more protective than Alternative SED-2 because of the additional component of annual monitoring. Annual monitoring would provide data to evaluate the rate of natural recovery of each wetland. Ecological receptors would be protected over time through naturally occurring processes with COC concentrations greater than.

Alternatives SED-4a and SED-4b would be more protective of human health and the environment than Alternatives SED-2 and SED-3. Excavation of sediment that is contaminated above PRGs would eliminate or reduce the potential for unacceptable human health and ecological risks as a result of exposure to contaminated sediment.

### 5.1.2 Compliance with ARARs and TBCs

Alternative SED-1 would not comply with chemical-specific ARARs or TBCs because no action would be taken to reduce contaminant concentrations. Compliance with location-specific ARARs would be purely incidental. Action-specific ARARs are not applicable to this alternative.

Alternatives SED-2 and SED-3 would comply with location-, and action-specific ARARs and TBCs. Chemical-specific ARARs and TBCs might eventually be achieved through LUCs. Monitoring would not be performed to evaluate natural recovery in Alternative SED-2. However, monitored natural recovery processes would be evaluated as part of Alternative SED-3.

Alternatives SED-4a and SED-4b would comply with all chemical-, location-, and action-specific ARARs and TBCs.

### 5.1.3 Long-Term Effectiveness and Permanence

Alternative SED-1 would have no long-term effectiveness and permanence because contaminated sediment would remain on site. Because there would be no LUCs to restrict the disturbance of sediment within the site boundaries, the potential would also exist for unacceptable risk to develop for human and/or ecological receptors. Because there would be no monitoring, potential COC concentration fluctuations would not be detected. Although COC concentrations might eventually decrease to PRGs through natural recovery, no monitoring would verify this.

Alternatives SED-2 and SED-3 would provide long-term effectiveness and permanence for human health receptors. Restricting access would prevent unacceptable risk from direct exposure of trespassers (including recreational fishermen) and workers. Alternative SED-3 would also include monitoring natural recovery processes that would allow for evaluation of ecological risks over time.

Alternatives SED-4a and SED-4b would provide long-term effectiveness and permanence. Excavation of sediment with COC concentrations greater than PRGs would effectively and permanently prevent unacceptable risk from exposure to contaminants and migration of sediment contaminants to surface water.

### 5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives SED-1, SED-2, SED-3, SED-4a, and SED-4b would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs might occur through sedimentation, leaching, biodegradation, and other natural attenuating factors, but Alternatives SED-1, SED-2, SED-4a, and SED-4b have no monitoring component to verify this. Alternatives SED-4a and SED-4b, however, would result in the relocation of contaminated sediment from the wetlands to a landfill.

### 5.1.5 Short-Term Effectiveness

Because no action would occur, implementation of Alternative SED-1 would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment. Alternative SED-1 would never achieve the RAOs and, although the PRGs might eventually be achieved through natural recovery, this would not be verified through monitoring.

No short-term risks would be incurred by workers from exposure to contaminated sediment during LUC implementation under Alternative SED-2.

Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site sampling activities in Alternative SED-3 and during on-site remedial activities in Alternatives SED-4a and SED-4b. However, the potential for exposure would be minimized by the wearing of appropriate PPE and compliance with OSHA regulations and site-specific health and safety procedures. For Alternatives SED-4a and SED-4b, any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.).

### 5.1.6 Implementability

Alternative SED-1 would be the easiest to implement because there would be no activities to implement.

Alternatives SED-2 and SED-3 would be easily implementable. The administration aspects of Alternatives SED-2 and SED-3 would be relatively simple to implement. If site ownership changed, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions for Alternatives SED-2 and SED-3 and monitoring for Alternative SED-3.

Alternatives SED-4a and SED-4b would be the most complicated to implement. The excavation component of Alternative SED-4a and dredging component of Alternative SED-4b could be performed with specialized construction equipment, resources, and materials that would be available for this purpose. Because the excavation component of Alternative SED-4a would be in wetland areas, dewatering and/or water flow diversion would be needed in some instances. The excavation component of Alternative SED-4b would be slightly more difficult than the excavation component of Alternative SED-4a, because the excavation would be in the boat dock area where equipment movement would be more challenging. Also under Alternative 4b, a dewatering area would be required to allow the sediment to drain. Existing vegetation would need to be removed and restored after excavation for Alternative SED-4a. Because of the shallow excavation depth and nature of the wetlands buried utilities may not be affected. Alternative SED-4a would require mats to support excavation equipment.

Non-hazardous waste landfills for the off-site disposal of the sediment and cleared vegetation would be readily available.

The administration aspects of Alternatives SED-4a and SED-4b would be moderately difficult to implement. The off-site transportation and disposal of the excavated sediment and vegetation would require the completion of administrative procedures, which could readily be accomplished. However, to perform excavation and reconstruction of a wetland during Alternative SED-4a and dredging during Alternative SED-4b, the involvement of the United States Army Corps of Engineers, FDEP and USEPA is required to properly permit construction activities. Special concerns would be associated with the hydraulic dredging process for Alternative SED-4B. Hydraulic dredging would require the addition of polymers to the dredged sediment for pumping purposes. If the polymers and sediment bags are not compatible with one another, the sediment bags could clog and prevent the dewatering process. Settling basins could be used instead of sediment bags, but dewatering using settling basins is significantly longer than with sediment bags because the sediment must fall through the water column rather than the water being filtered though the sediment bags. Additionally, settling basins would require the addition of flocculants to help speed up the settlement process. Due to the time associated with the dewatering process, this FS assumes the use of sediment bags rather than settling basins.

### 5.1.7 Cost

The capital and O&M costs and NPW of the sediment alternatives for Wetland 3 are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $28,000 | $50,000 | $78,000 |
| SED-3 | $28,000 | $121,000 | $149,000 |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 5A are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $25,000 | $50,000 | $75,000 |
| SED-3 | $25,000 | $113,000 | $138,000 |
| SED-4a | $1,176,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 15 are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $23,000 | $50,000 | $73,000 |
| SED-3 | $23,000 | $144,000 | $167,000 |
| SED-4a | $1,167,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 16 are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $23,000 | $50,000 | $73,000 |
| SED-3 | $23,000 | $151,000 | $174,000 |
| SED-4a | $570,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 18A are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $24,000 | $50,000 | $74,000 |
| SED-3 | $24,000 | $148,000 | $172,000 |
| SED-4a | $1,077,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 18B are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $22,000 | $50,000 | $72,000 |
| SED-3 | $22,000 | $146,000 | $168,000 |
| SED-4a | $428,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 48 are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $28,000 | $50,000 | $78,000 |
| SED-3 | $28,000 | $111,000 | $139,000 |
| SED-4a | $2,763,000 | - | - |

The capital and O&M costs and NPW of the sediment alternatives for Wetland 64 are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $35,000 | $50,000 | $85,000 |
| SED-3 | $35,000 | $428,000 | $463,000 |
| SED-4a | $10,207,000 | - | - |
| SED-4b | | - | - |

* Costs for Alternative SED-4b are included in the costs for Alternative SED-4a. These two alternatives will be conducted simultaneously.

The capital and O&M costs and NPW of the sediment alternatives for all the wetlands are as follows.

| Alternative | Capital Cost | NPW of O&M | NPW |
|---|---|---|---|
| SED-1 | $0 | $0 | $0 |
| SED-2 | $208,000 | $400,000 | $608,000 |
| SED-3 | $208,000 | $1,362,000 | $1,570,000 |
| SED-4a | $17,388,000 | - | - |
| SED-4b | | - | - |

* Costs for Alternative SED-4b are included in the costs for Alternative SED-4a. These two alternatives will be conducted simultaneously.

Detailed cost estimates are provided in Appendix C.

## 5.2 SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Table 5-1 summarizes the comparative analysis of the sediment remedial alternatives.

**TABLE 5-1**

**SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES - SEDIMENT**
**SITE 41 FEASIBILITY STUDY**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Evaluation Criterion | Alternative SED-1: No Action | Alternative SED-2: Land Use Restrictions/Institutional Controls (LUCs) | Alternative SED-3: LUCs and Natural Recovery | Alternative SED-4a: Ex-Situ Treatment - Removal (Excavation) and Disposal | Alternative SED-4b: Ex-Situ Treatment - Removal (Dredging) and Disposal, Wetland 64 Boat Dock Area |
|---|---|---|---|---|---|
| Overall Protection of Human Health and Environment | Would not provide protection of human health and the environment. Because no monitoring would be performed, potential migration of COCs would not be detected. | Would be protective of human health by preventing unacceptable risks to trespassers and workers from direct exposure to contaminated sediment. LUCs would also prohibit fishing, which would prevent human exposure to fish tissue uptake. | Would be protective of human health by preventing unacceptable risks to trespassers and workers from direct exposure to contaminated sediment. LUCs would also prohibit fishing, which would prevent human exposure to potentially contaminated fish tissue. Alternative SED-3 would be slightly more protective than Alternative SED-2 because of the additional component of annual monitoring. Annual monitoring would provide data to evaluate the rate of natural recovery of each wetland. Ecological receptors would be protected over time through naturally occurring processes that would be monitored and documented. | Would be more protective of human health and the environment than Alternatives SED-2 and SED-3. Excavation of sediment PRGs would eliminate or reduce the potential for unacceptable human health and ecological risks as a result of exposure to contaminated sediment. | Would be more protective of human health and the environment than Alternatives SED-2 and SED-3. Excavation of sediment PRGs would eliminate or reduce the potential for unacceptable human health and ecological risks as a result of exposure to contaminated sediment. |
| Compliance with ARARs and TBCs:<br>Chemical-Specific<br>Location-Specific<br>Action-Specific | <br><br>Would not comply<br>Would not comply<br>Not applicable | <br><br>Eventually would comply<br>Would comply<br>Would comply | <br><br>Eventually would comply<br>Would comply<br>Would comply | <br><br>Would comply<br>Would comply<br>Would comply | <br><br>Would comply<br>Would comply<br>Would comply |
| Long-Term Effectiveness and Permanence | Would have no long-term effectiveness and permanence. Contaminant reduction or migration would not be detected since monitoring would not occur. | Would provide long-term effectiveness and permanence. Although no active treatment of contaminated soil would occur, risks to human health would be controlled. | Would provide long-term effectiveness and permanence. Although no active treatment of contaminated soil would occur, risks to human health and the environment would be controlled. | Would be effective in the long term because the COCs would be removed from the site and disposed in a suitable landfill outside the facility, resulting in residual levels that would not longer pose an unacceptable risk to recreational and ecological receptors. | Would be effective in the long term because the COCs would be removed from the site and disposed in a suitable landfill outside the facility, resulting in residual levels that would not longer pose unacceptable risk to recreational and ecological receptors. |
| Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment | Would not reduce toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs would occur through natural dispersion, dilution, or other attenuation processes, but no monitoring would be performed to verify. | Would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs would occur through sedimentation, leaching, biodegradation, and other natural attenuating factors, but there would be no monitoring component to verify this. | Would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Some reduction of the toxicity and volume of COCs would occur through sedimentation, leaching, biodegradation, and other natural attenuating factors, which would be verified through monitoring. | Would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Alternative SED-4a, however, would result in the relocation of contaminated sediment from the wetlands to a landfill. | Would not reduce the toxicity, mobility, or volume of contaminants through treatment because no treatment would occur. Alternative SED-4b, however, would result in the relocation of contaminated sediment from the Wetland 64 to a landfill. |

**TABLE 5-1**

**SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES - SEDIMENT**
**SITE 41 FEASIBILITY STUDY**
**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**


| Evaluation Criterion | Alternative SED-1: No Action | Alternative SED-2: Land Use Restrictions/Institutional Controls (LUCs) | Alternative SED-3: LUCs and Natural Recovery | Alternative SED-4a: Ex-Situ Treatment - Removal (Excavation) and Disposal | Alternative SED-4b: Ex-Situ Treatment - Removal (Dredging) and Disposal, Wetland 64 Boat Dock Area |
|---|---|---|---|---|---|
| Short-Term Effectiveness | Would not pose any risks to on-site workers or result in short-term adverse impact to the local community and the environment. Would never achieve the RAOs and, although the cleanup goals might eventually be achieved through natural attenuation, this would not be verified through monitoring. | No short-term risks would be incurred by workers from exposure to contaminated sediment during LUC implementation. | No short-term risks would be incurred by workers from exposure to contaminated sediment during LUC implementation. Some short-term risks could be incurred by workers from exposure to contaminated sediment during on site sampling activities. However, the potential for exposure would be minimized by the wearing of appropriate PPE, and compliance with OSHA regulations and site-specific health and safety procedures. | Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site remedial activities. However, the potential for exposure would be minimized by the wearing of appropriate PPE and compliance with OSHA regulations and site-specific health and safety procedures. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.). | Some short-term risks could be incurred by workers from exposure to contaminated sediment during on-site remedial activities. However, the potential for exposure would be minimized by the wearing of appropriate PPE, and compliance with OSHA regulations and site-specific health and safety procedures. Any potential negative short-term impacts to the surrounding community and environment from fugitive emissions and/or spillage of contaminated sediment could be minimized through the implementation of appropriate engineering controls (e.g., perimeter air monitoring, spill prevention procedures, etc.). |
| Implementability | Because no action would occur, Alternative 1 would be readily implementable. | Would be easily implementable. The administration aspects of would be relatively simple to implement. If site ownership changed, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions. | Would be easily implementable. The administration aspects of would be relatively simple to implement. If site ownership changed, appropriate provisions would be incorporated into the property transfer documents to ensure continued implementation of land use restrictions and monitoring. | Excavation equipment considered under this alternative is typical in the construction industry and readily available from several local sources. Suitable TSDFs are available for treatment and/or direct disposal of the excavated sediment and have been identified at nearby locations. | Excavation equipment considered under this alternative is typical in the construction industry and readily available from several local sources. Suitable TSDFs are available for treatment and/or direct disposal of the excavated sediment and have been identified at nearby locations. |
| Costs for all wetlands:<br>Capital<br>NPW of O&M<br>NPW | <br>$0<br>$0<br>$0 | <br>$208,000<br>$400,000<br>$608,000 | <br>$208,000<br>$1,362,000<br>$1,570,000 | <br>$17,388,000<br>Includes costs for Alternative SED-4b at Wetland 64. | <br>$10,207,000<br>Includes costs for Alternatives SED-4a and SED-4b at Wetland 64. |

ARARs Applicable or Relevant and Appropriate Requirements
COCs Chemicals of concern
LUCs Land use controls
NPW Net present worth
O&M Operation and maintenance
PPE Personal Protective Equipment
PRG Preliminary Remediation Goal
RAOs Remedial Action Objectives
TSDF Treatment Storage and Disposal Facility

# REFERENCES

Ecology & Environment, Inc. (E & E), 1991a. Contamination Assessment/Remedial Activities Investigation, Sanitary Landfill (Site 1), Naval Air Station Pensacola, Pensacola, Florida, Interim Data Report, Pensacola, FL.

E & E, 1991b. Interim Data Report, Contamination Assessment/Remedial Investigation, Sanitary Landfill (Site 1), Naval Air Station, Pensacola, Florida, Pensacola, Florida.

EnSafe, 1997. Remedial Investigation Report OU 2, Naval Air Station, Pensacola, Florida. Memphis, Tennessee.

EnSafe, 1998. Final Record of Decision, Operable Unit 1, Naval Air Station Pensacola. Memphis, Tennessee.

EnSafe, Inc., 2007a. Final Site 41 Remedial Investigation Report for Naval Air Station Pensacola, Pensacola, Florida. Memphis, Tennessee.

EnSafe, 2007b. RI Report Addendum for Naval Air Station Pensacola, Pensacola, Florida. Memphis, Tennessee.

EnSafe/Allen and Hoshall (E/A&H), 1996. Final Remedial Investigation Report — Site 1, NAS Pensacola, Florida. Memphis, Tennessee.

E/A&H,1997. Final Remedial Investigation/ Feasibility Study Sampling and Analysis Plan Addendum, Site 41, NAS Pensacola, Florida. Pensacola, Florida.

Geraghty & Miller, Inc., 1984. Verification Study, Assessment of Potential Ground Water Pollution at Naval Air Station, Pensacola, Florida. Tampa, Florida: Geraghty & Miller, Inc.

Geraghty & Miller, Inc., 1986. Characterization Study, Assessment of Potential Ground Water Pollution at Naval Air Station, Pensacola, Florida. Tampa, Florida: Geraghty & Miller, Inc.

NEESA, 1983. Initial Assessment Study of Naval Air Station, Pensacola, Florida, Port Hueneme, California. (NEESA 13 015).

Tetra Tech NUS, Inc. (TtNUS), 2003. Final 3rd Annual Monitoring Report For Long-Term Monitoring For Operable Unit 1 Naval Air Station Pensacola, Florida.

TtNUS, 2004. Optimization Study Report for Operable Unit 1 Naval Air Station Pensacola, Florida.

TtNUS, 2006. Draft Site Assessment Report Addendum for Underground Storage Tank (UST) Site 18, Naval Air Station Pensacola, Pensacola, Florida.

United States Environmental Protection Agency (USEPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/G-89/004. Interim Final. October.

USEPA, 1991. Pensacola Naval Air Station Advanced Wetlands Identification. USEPA, Environmental Services Division, Athens, Georgia.

# APPENDIX A

# ECOLOGICAL PRG CALCULATIONS

**PRGs for Sediment Invertebrates**

Risks to sediment invertebrates were determined in the BERA using a line of evidence approach that included sediment chemistry, benthic community analysis, and toxicity tests. Data for all three lines of evidence were only available for five of the wetlands (3, 5A, 16, 64, and 18B) while two lines evidence (sediment chemistry and toxicity tests) were available at Wetland 5B.

The first step for developing PRGs was to determine which sediment samples were considered "toxic" based on the evaluations in the BERA. Table 1 presents a summary of the toxicity tests and benthic community analysis for each of the locations where the data were collected, along with the overall conclusion from the BERA as to whether sediment invertebrates at the location were likely impacted.

As discussed in Section 4.2 of the RI report, the wetlands were placed into one of five groups based on contaminants, physical characteristics, and whether they were impacted by IR sites. The second step involved compiling the analytical data for each of the samples in Table 1 and determining no observed effects concentrations (NOECs) and lowest observed effects concentrations (LOECs) for each group base don the samples within that group. Tables 2 through 5 present the NOECs and LOECs for each of the groups as follows:

- Table 2: Wetlands 3 and 5A
- Table 3: Wetland 5B
- Table 4: Wetlands 16 and 18B
- Table 5: Wetland 64

On each of the tables, the columns are shaded green if the samples are considered non-toxic and they are shaded yellow if they are considered toxic. Also, individual cells are shaded red, blue, or black, for the following reasons:

- ***Red:*** The cell is shaded red if the value is the maximum detected concentration and it occurred in a non-toxic sample. The concentration in the red cell is considered the NOEC for that parameter and a LOEC cannot be calculated for that parameter.
- ***Blue:*** The cell is shaded blue if the maximum detected concentration for the data set occurred in a toxic sample. The concentration in the blue cell is the maximum detected concentration in a non-toxic sample and is considered the NOEC for that parameter.

- ***Black:*** The cell is shaded black if the maximum detected concentration for the data set occurred in a toxic sample. The concentration in the black cell (considered the LOEC) is the minimum detected concentration in a toxic sample that is greater than the maximum detected concentration in a non-toxic sample. This was done to ensure that the LOEC was not lower than the NOEC.

There is considerable uncertainty and limitations in NOECs and LOECs developed with this methodology, especially given the limited data set for each group of samples. This approach identifies the lowest chemical concentrations that are associated with a toxic response (LOEC) (which must be greater than the NOEC), but it is not known whether the LOEC for that chemical was actually responsible for the observed toxic response. In several cases, the LOEC is less than the reference of refinement values used in the BERA or the NOEC is less than the screening level. Also, in some cases, the difference in concentrations between the NOEC and LOEC are well within the range of field and laboratory errors so it is unlikely that the LOEC for that chemical is responsible for the toxic effect.

Only the parameters that were retained as COPCs for the wetlands within each group are presented on the tables except for Table 3 (see below). In cases where the NOEC was lower than the screening level or the reference concentration, the screening level or reference concentration was placed in the NOEC column and footnoted as such. The following describes the development of the NOECs and LOECs for each group.

Table 2 presents the NOECs and LOECs for the sediment samples collected at Wetlands 3 and 5A. For most of the organic chemicals, the maximum detected concentrations were in the non-toxic samples or the parameters were not detected in any of the samples. The only organic chemical for which a NOEC and LOEC could be developed was endosulfan sulfate, but the difference in concentrations between these two values is very low. Also, it is not likely that the very low concentration of 0.0072 mg/kg is responsible for the observed toxicity in that sample. There are several metals that have a considerable spread between the NOEC and LOEC and any of these metals, or some combination could be responsible for toxicity. These metals include antimony, cadmium, copper, lead, and zinc. Note that for cadmium and lead, the reference concentrations were greater than the NOECs. The toxic sample in Wetland 5A (041M5A0501) was the source of the LOECs for antimony, cadmium, copper, and lead. However, although sample 041M5A0501 had decreased growth in the toxicity test, the location had the greatest levels of benthic diversity based on the benthic community analysis. Therefore, there is uncertainty in whether those LOECs should actually be LOECs or NOECs.

Table 3 presents the NOECs for the sediment samples collected at Wetland 5B. None of the samples in this wetland were classified as toxic so the maximum detected concentrations in the samples used for the toxicity tests were considered the NOECs. All of the chemicals that were detected in at least one of the samples where toxicity tests were conducted were presented on Table 3 because although this wetland is not being considered in the FS, toxicity data from this wetland could be used to evaluate other wetlands at the site. The concentrations of several metals, in particular cadmium, chromium, and lead were elevated as compared to the reference concentration and refinement values.

Table 4 presents the NOECs and LOECs for the sediment samples collected at Wetlands 16 and 18B. None of the samples in this wetland were classified as toxic so the maximum detected concentrations in the samples used for the toxicity tests were considered the NOECs. The chemical concentrations were generally low in the samples tested in these wetlands. The concentration of 4,4'-DDT in the toxicity sample from Wetland 18B was slightly elevated as compared to the reference concentration and refinement value.

Table 5 presents the NOECs and LOECs for the sediment samples collected at Wetland 64. For most chemicals, there was not a large difference between the values for the NOECs and LOECs so it is difficult to determine which chemicals are responsible for the observed toxicity.

Tables 6, 7, and 8 present a comparison of the chemical concentrations for each sample to the associated LOECs (or NOECs if a LOEC was not developed) for that group of wetlands. The tables are meant for informational purposes to see the impacts of the LOECs on the various data sets. As can be seen from the tables, there are several samples in each wetland that exceed the LOECs (or NOECs). This likely indicates that the LOECs for several of the parameters are very conservative.

TABLE 1

SUMMARY OF SEDIMENT INVERTEBRATE IMPACTS
SITE 41 - NAS PENSACOLA

| Wetland | Sample Location | Toxicity Test Information: Species | Survival (percent) | Growth (weight mg) | Emergence (percent) | Benthic Community Analysis: Diversity | Evenness | Richness | Overall Conclusion of BERA |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 041M030201 | C. tentans | 83 | 2.9 | 60 | 2.24 | 0.97 | 9.77 | |
| | 041M030701 | C. tentans | 91 | 2 * | 70 | 1.92 | 1.39 | 3.38 | potential impact around this location |
| 5A | 041M5A0401 | C. tentans | 100 | 2.6 | 75 | 2.56 | 1.11 | 9.76 | |
| | 041M5A0501 | C. tentans | 100 | 1.6 * | 50 | 3.16 | 1.37 | 9.74 | potential impact around this location based on the toxicity tests but this location had the highest levels of benthic diversity |
| | 041M5A0601 | C. tentans | 83 | 2.8 | 75 | 2.43 | 1.25 | 6.88 | |
| 5B | 041M5B02 | H. azteca | 97.5 | 0.06 | | | | | no impacts |
| | 041M5B03 | H. azteca | 97.5 | 0.07 | | | | | no impacts |
| | 041M5B03 Dup | H. azteca | 97.5 | 0.1 | | | | | no impacts |
| | 041M5B04 | H. azteca | 96.25 | 0.06 | | | | | no impacts |
| | 041M5B05 | H. azteca | 100 | 0.08 | | | | | no impacts |
| | 041M5B06 | H. azteca | 100 | 0.1 | | | | | no impacts |
| 16 | 041M160301 | N. arenaceodentata | 100 | 8 | | 1.69 | 1.05 | 4.72 | little or no impact |
| | 041M160301 | L. plumulosus | 93 | | | | | | no statistical differences |
| 64 | 041M640401 | L. plumulosus | 78 * | | | 2.42 | 1.01 | 10.76 | toxic chemicals likely stressing system; petroleum odors |
| | | N. arenaceodentata | 100 | 8 | | | | | |
| | 041M640501 | L. plumulosus | 96 | | | 3.3 | 1.22 | 14.76 | |
| | | N. arenaceodentata | 96 | 7.2 * | | | | | |
| | 041M640601 | L. plumulosus | 74 * | | | 2.64 | 1.14 | 9.79 | toxic chemicals likely stressing system; petroleum odors |
| | | N. arenaceodentata | 88 | 8.5 | | | | | |
| 18B | 041M18B101 | N. arenicola | 100 | 8.4 | | 2.36 | 1.03 | 9.73 | sediment not influencing flora and fauna |
| | | L. plumulosus | 100 | | | | | | |

* Indicates that the endpoint was statistically lower than the laboratory control sample and is considered impacted.

TABLE 2

DEVELOPMENT OF NOECS AND LOECS FOR WETLANDS 3 AND 5A
SITE 41 - NAS PENSACOLA

| WETLAND<br>EVENT<br>LOCATION<br>SAMPLE<br>SAMPLE DATE | Screening Level | Freshwater Reference Concentration | Refinement Value | 3<br>03<br>41M0302<br>041M030201<br>19970827 | 3<br>03<br>41M0307<br>041M030701<br>19970827 | 5A<br>03<br>41M5A04<br>041M5A0401<br>19970828 | 5A<br>03<br>41M5A05<br>041M5A0501<br>19970828 | 5A<br>03<br>41M5A06<br>041M5A0601<br>19970828 | No Observed Effects Concentration | Lowest Observed Effects Concentration |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (MG/KG)** | | | | | | | | | | |
| CARBON DISULFIDE | NA | NA | NA | 0.017 J | 0.011 U | 0.0076 U | 0.0079 U | 0.0082 U | 0.017 | NA[1] |
| **PESTICIDES/PCBs (MG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.00122 | 0.05 | 0.00781 | 0.014 J | 0.049 | 0.10 | 0.10 U | 0.0013 J | 0.1 | NA[1] |
| 4,4'-DDE | 0.00207 | 0.04 | 0.374 | 0.016 U | 0.011 | 0.057 | 0.10 U | 0.0036 J | 0.057 | NA[1] |
| 4,4'-DDT | 0.00119 | 0.02 | 0.00477 | 0.0037 J | 0.0093 | 0.0072 | 0.10 U | 0.0032 J | 0.02[2] | 0.02[2] |
| ALPHA-BHC | 0.00032 | NA | 0.00099 | 0.0085 U | 0.0036 U | 0.0026 U | 0.054 U | 0.0028 U | NA[3] | NA[3] |
| ALPHA-CHLORDANE | 0.0017 | NA | 0.00479 | 0.0085 U | 0.0036 U | 0.0045 | 0.054 U | 0.00026 U | 0.0045 | NA[1] |
| BETA-BHC | 0.00032 | NA | 0.00099 | 0.0085 U | 0.0036 U | 0.0026 U | 0.054 U | 0.0028 U | NA[3] | NA[3] |
| DELTA-BHC | 0.00032 | NA | 0.00099 | 0.0085 U | 0.0036 U | 0.0026 U | 0.054 U | 0.0028 U | NA[3] | NA[3] |
| ENDOSULFAN I | NA | NA | NA | 0.0085 U | 0.0036 U | 0.0052 | 0.054 U | 0.0003 U | 0.0052 | NA[1] |
| ENDOSULFAN SULFATE | NA | NA | NA | 0.016 U | 0.0072 J | 0.0023 J | 0.10 U | 0.00066 J | 0.0023 | 0.0072 |
| ENDRIN | 0.0033 | NA | NA | 0.0028 J | 0.007 U | 0.00069 U | 0.0024 U | 0.0011 J | 0.0033[4] | NA[1] |
| GAMMA-BHC (LINDANE) | 0.00032 | NA | 0.99 | 0.0047 U | 0.0036 U | 0.00024 J | 0.054 U | 0.0028 U | 0.00032[4] | NA[1] |
| GAMMA-CHLORDANE | 0.0017 | NA | 0.00479 | 0.0085 U | 0.00074 J | 0.0079 J | 0.054 U | 0.00014 U | 0.0079 | NA[1] |
| **INORGANICS (MG/KG)** | | | | | | | | | | |
| ANTIMONY | 12 | 4.43 | NA | 4.9 UJ | 2.1 UJ | 1.5 UJ | 27.7 J | 2 J | 4.43[2] | 27.7 |
| BARIUM | NA | 14 | NA | 87 | 18.7 | 12.5 | 17.2 | 6.9 | 87 | NA[1] |
| CADMIUM | 0.68 | 1.8 | | 2 UJ | 9.3 | 0.42 J | 3.2 | 1.2 | 1.8[2] | 3.2 |
| COPPER | 18.7 | 19.5 | 108 | 2 U | 4 | 21.5 | 108 | 25.6 | 25.6 | 108 |
| IRON | NA | 11912 | NA | 246000 | 67100 | 1090 | 3020 | 546 | 246000 | NA[1] |
| LEAD | 30.2 | 82.5 | 112 | 20.6 | 35.6 | 54.5 | 258 | 75.5 | 82.5[2] | 258 |
| MANGANESE | NA | 38 | NA | 236 | 42.6 | 15.4 | 21.3 | 8.6 | 236 | NA[1] |
| SELENIUM | NA | 3.45 | NA | 5.4 | 2 J | 0.26 U | 0.60 J | 0.28 U | 5.4 | NA[1] |
| ZINC | 124 | 36.73 | | 45.8 | 234 | 77.1 | 394 | 103 | 103 | 234 |
| **MISCELLANEOUS PARAMETERS** | | | | | | | | | | |
| TOTAL ORGANIC CARBON (MG/KG) | | | | 100000 | | 7000 | 7400 | 10000 | | |

Shading:
Green: Signifies non-toxic sample
Yellow: Signifies toxic sample
Blue: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a toxic sample.
Red: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a non-toxic sample.
Black: LOEC based on lowest concentration in toxic sample above the NOEC when maximum detected concentration for the parameter is in a toxic sample.

1 - Not applicable because the maximum detected concentration of the parameter was in a non-toxic sample.
2 - Value presented is the reference concentration because it is greater than the LOEC or NOEC.
3 - Not applicable because the parameter was not detected in any of the samples.
4 - Value presented is the screening level because it is greater than the NOEC.

NOEC - No Observed Effects Concentration
LOEC - Lowest Observed Effects Concentration

TABLE 3

DEVELOPMENT OF NOECS AND LOECS FOR WETLANDS 5B
SITE 41 - NAS PENSACOLA

| WETLAND<br>EVENT<br>LOCATION<br>SAMPLE<br>SAMPLE DATE | Screening Level | Freshwater Reference Concentration | Refinement Value | 5B<br>04<br>041M5B02<br>041M5B0202<br>20040406 | 5B<br>04<br>041M5B03<br>041M5B0301<br>20040406 | 5B<br>04<br>041M5B04<br>041M5B0401<br>20040406 | 5B<br>04<br>041M5B05<br>041M5B0501<br>20040406 | 5B<br>04<br>041M5B06<br>041M5B0601<br>20040406 | No Observed Effects Concentration | Lowest Observed Effects Concentration |
|---|---|---|---|---|---|---|---|---|---|---|
| **VOLATILES (MG/KG)** | | | | | | | | | | |
| ACETONE | NA | NA | NA | 0.028 I | 0.021 I | 0.012 U | 0.013 U | 0.02 U | 0.028 | NA(2) |
| CIS-1,2-DICHLOROETHENE | NA | NA | NA | 0.0024 U | 0.0019 U | 0.0017 U | 0.0018 U | 0.0077 I | 0.0077 | NA(2) |
| VINYL CHLORIDE | NA | NA | NA | 0.0037 I | 0.0024 U | 0.0021 U | 0.0023 U | 0.0035 U | 0.0037 | NA(2) |
| **SEMIVOLATILES (MG/KG)** | | | | | | | | | | |
| 3&4-METHYLPHENOL | NA | NA | NA | 0.089 U | 0.073 I | 0.058 U | 0.062 U | 0.20 I | 0.2 | NA(2) |
| BENZO(A)ANTHRACENE | 0.0748 | NA | 0.693 | 0.12 I | 0.098 I | 0.0044 U | 0.012 U | 0.017 U | 0.12 | NA(2) |
| BIS(2-ETHYLHEXYL)PHTHALATE | 0.182 | NA | 2.647 | 0.19 I | 0.19 I | 0.064 U | 0.068 U | 0.15 I | 0.19 | NA(2) |
| CHRYSENE | 0.108 | NA | 0.846 | 0.16 | 0.12 | 0.0058 U | 0.015 U | 0.056 I | 0.16 | NA(2) |
| DI-N-BUTYL PHTHALATE | 0.182 | NA | 2.647 | 0.087 U | 0.33 I | 0.056 U | 0.06 U | 0.089 U | 0.33 | NA(2) |
| FLUORANTHENE | 0.113 | NA | 1.494 | 0.29 | 0.20 | 0.015 I | 0.039 I | 0.069 I | 0.29 | NA(2) |
| PYRENE | 0.153 | NA | 1.398 | 0.21 | 0.16 | 0.013 I | 0.037 I | 0.059 I | 0.21 | NA(2) |
| **PESTICIDES/PCBs (MG/KG)** | | | | | | | | | | |
| 4,4'-DDE | 0.00207 | 0.04 | 0.374 | 0.018 I | 0.023 I | 0.0078 U | 0.0083 U | 0.024 I | 0.04(1) | NA(2) |
| AROCLOR-1260 | 0.0216 | NA | 0.189 | 0.15 | 0.06 | 0.0064 U | 0.02 I | 0.096 | 0.15 | NA(2) |
| BETA-BHC | 0.00032 | NA | 0.00099 | 0.00064 U | 0.00052 U | 0.00042 U | 0.00045 U | 0.0029 I | 0.0029 | NA(2) |
| DIELDRIN | 0.000715 | NA | 0.0043 | 0.029 | 0.014 | 0.0086 | 0.009 | 0.10 | 0.1 | NA(2) |
| **INORGANICS (MG/KG)** | | | | | | | | | | |
| ALUMINUM | NA | 13610 | NA | 3400 | 860 J | 300 | 420 | 760 | 13610(1) | NA(2) |
| ANTIMONY | 12 | 4.43 | NA | 3.6 I | 2.2 I | 1.8 I | 1.1 I | 2.5 I | 4.43(1) | NA(2) |
| ARSENIC | 7.24 | 6.62 | 41.6 | 0.84 I | 0.56 U | 0.46 U | 0.46 U | 0.66 U | 6.62(1) | NA(2) |
| BARIUM | NA | 14 | NA | 18 | 3.3 J | 1.5 | 1.8 | 4.5 | 18 | NA(2) |
| BERYLLIUM | NA | 0.84 | NA | 0.15 I | 0.068 I | 0.038 I | 0.036 I | 0.066 I | 0.84(1) | NA(2) |
| CADMIUM | 0.68 | 1.8 | 4.21 | 31 | 1 J | 0.95 | 1.1 | 5.1 | 31 | NA(2) |
| CHROMIUM | 52.3 | 39.37 | 160 | 470 | 24 J | 14 | 23 | 55 | 470 | NA(2) |
| COBALT | NA | 2.8 | NA | 4.1 | 0.40 I | 0.30 I | 0.39 I | 1.1 I | 4.1 | NA(2) |
| COPPER | 18.7 | 19.5 | 108 | 90 | 12 J | 5.3 | 7.8 | 16 | 90 | NA(2) |
| IRON | NA | 11912 | NA | 1800 | 470 J | 210 | 290 | 800 | 11912(1) | NA(2) |
| LEAD | 30.2 | 82.5 | 112 | 420 | 38 J | 19 | 24 | 48 | 420 | NA(2) |
| MANGANESE | NA | 38 | NA | 11 | 2.8 | 1.1 I | 4.7 | 21 | 38(1) | NA(2) |
| MERCURY | 0.13 | 0.55 | 0.696 | 0.22 | 0.086 | 0.0068 U | 0.019 I | 0.12 | 0.55(1) | NA(2) |
| NICKEL | 15.9 | 9.28 | 42.8 | 20 | 1.2 I | 0.61 I | 0.97 I | 3 I | 20 | NA(2) |
| SILVER | 0.73 | 2.1 | 1.77 | 6.4 | 0.18 UJ | 0.15 U | 0.15 U | 0.38 I | 6.4 | NA(2) |
| VANADIUM | NA | 28.67 | NA | 6.7 | 1.1 I | 0.55 I | 0.86 I | 1.2 I | 28.67(1) | NA(2) |
| ZINC | 124 | 36.73 | 271 | 200 | 45 J | 28 | 19 | 60 | 200 | NA(2) |
| **MISCELLANEOUS PARAMETERS** | | | | | | | | | | |
| TOTAL ORGANIC CARBON (MG/KG) | | | | 15000 | 3800 | 3500 | 14000 | 4100 | | |

Shading:
Green: Signifies non-toxic sample
Red: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a non-toxic sample.

1 - Value presented is the reference concentration because it is greater than the NOEC.
2 - Not applicable because the maximum detected concentration of the parameter was in a non-toxic sample.

NOEC - No Observed Effects Concentration
LOEC - Lowest Observed Effects Concentration

TABLE 4

DEVELOPMENT OF NOECS AND LOECS FOR WETLANDS 16 and 18B
SITE 41 - NAS PENSACOLA

| WETLAND<br>EVENT<br>LOCATION<br>SAMPLE<br>SAMPLE DATE | Screening Level | Saltwater Reference Concentration | Refinement Value | 16<br>03<br>41M1603<br>041M160301<br>19970904 | 18B<br>03<br>41M18B1<br>041M18B101<br>19970829 | No Observed Effects Concentration | Lowest Observed Effects Concentration |
|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (MG/KG)** | | | | | | | |
| 2,2'-OXYBIS(1-CHLOROPROPANE) | NA | NA | NA | 0.87 UJ | 0.67 U | NA[4] | NA[4] |
| 2,4-DIMETHYLPHENOL | NA | NA | NA | 0.87 U | 0.67 U | NA[4] | NA[4] |
| 2-METHYLPHENOL | NA | NA | NA | 0.87 U | 0.67 U | NA[4] | NA[4] |
| 4-METHYLPHENOL | NA | NA | NA | | | NA[4] | NA[4] |
| PHENOL | NA | NA | NA | 0.87 U | 0.67 U | NA[4] | NA[4] |
| **PESTICIDES/PCBs (MG/KG)** | | | | | | | |
| 4,4'-DDD | 0.00122 | 0.05 | 0.00781 | 0.0069 J | 0.036 | 0.05[1] | NA[2] |
| 4,4'-DDT | 0.00119 | 0.02 | 0.00477 | 0.016 | 0.11 | 0.11 | NA[2] |
| ALDRIN | NA | NA | NA | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| ALPHA-BHC | 0.00032 | NA | 0.00099 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| ALPHA-CHLORDANE | 0.0017 | NA | 0.00479 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| BETA-BHC | 0.00032 | NA | 0.00099 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| DELTA-BHC | 0.00032 | NA | 0.00099 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| ENDOSULFAN I | NA | NA | NA | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| ENDRIN | 0.0033 | NA | NA | 0.0013 J | 0.0067 U | 0.0033[3] | NA[2] |
| ENDRIN ALDEHYDE | 0.0033 | NA | NA | 0.0087 U | 0.0067 U | NA[4] | NA[4] |
| ENDRIN KETONE | 0.0033 | NA | NA | 0.0087 U | 0.0067 U | NA[4] | NA[4] |
| GAMMA-BHC (LINDANE) | 0.00032 | NA | 0.99 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| GAMMA-CHLORDANE | 0.0017 | NA | 4.79 | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| HEPTACHLOR | NA | NA | NA | 0.0045 U | 0.0035 U | NA[4] | NA[4] |
| **INORGANICS (MG/KG)** | | | | | | | |
| ALUMINUM | NA | 4274 | NA | 5320 J | 605 | 5320 | NA[2] |
| ARSENIC | 7.24 | 2.14 | 41.6 | 5.5 | 13.8 | 13.8 | NA[2] |
| BARIUM | NA | 3.84 | NA | 4.7 | 1.8 J | 4.7 | NA[2] |
| BERYLLIUM | NA | 0.13 | NA | 0.26 | 0.07 J | 0.26 | NA[2] |
| IRON | NA | 2684 | NA | 17000 | 20800 | 20800 | NA[2] |
| LEAD | 30.2 | 21 | 112 | 29.4 | 5.9 | 30.2[3] | NA[2] |
| MANGANESE | NA | 9.8 | NA | 39 | 10.8 | 39 | NA[2] |
| SELENIUM | NA | 0.66 | NA | 1 J | 0.74 J | 1 | NA[2] |
| VANADIUM | NA | 8.59 | NA | 15.3 | 6.3 | 15.3 | NA[2] |
| **MISCELLANEOUS PARAMETERS** | | | | | | | |
| TOTAL ORGANIC CARBON (MG/KG) | | | | 17000 | 9000 | | |

Shading:
Green: Signifies non-toxic sample
Red: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a non-toxic sample.

1 - Value presented is the reference concentration because it is greater than the NOEC.
2 - Not applicable because the maximum detected concentration of the parameter was in a non-toxic sample.
3 - Value presented is the screening level because it is greater than the NOEC.
4 - Not applicable because the parameter was not detected in any of the samples.

NOEC - No Observed Effects Concentration
LOEC - Lowest Observed Effects Concentration

TABLE 5

DEVELOPMENT OF NOECS AND LOECS FOR WETLANDS 64
SITE 41 - NAS PENSACOLA

| WETLAND<br>EVENT<br>LOCATION<br>SAMPLE<br>SAMPLE DATE | Screening Level | Saltwater Reference Concentration | Refinement Value | 64<br>03<br>41M6404<br>41M640401<br>19970904 | 64<br>03<br>41M6405<br>41M640501<br>19970904 | 64<br>03<br>41M6406<br>41M640601<br>19970903 | No Observed Effects Concentration | Lowest Observed Effects Concentration |
|---|---|---|---|---|---|---|---|---|
| **SEMIVOLATILES (MG/KG)** | | | | | | | | |
| BIS(2-ETHYLHEXYL)PHTHALATE | 0.182 | NA | 2.647 | 3.3 | 2 | 3.9 | 2 | 3.3 |
| CARBAZOLE | NA | NA | NA | 0.32 J | 0.35 J | 0.80 J | 0.35 | 0.8 |
| DIBENZOFURAN | NA | NA | NA | 1.3 U | 0.13 J | 0.35 J | 0.13 | 0.35 |
| **PESTICIDES/PCBs (MG/KG)** | | | | | | | | |
| 4,4'-DDD | 0.00122 | 0.05 | 0.00781 | 0.089 | 0.03 | 0.053 | 0.05(1) | 0.089 |
| AROCLOR-1260 | 0.0216 | NA | 0.189 | 0.30 | 0.28 | 0.18 | 0.28 | 0.3 |
| DIELDRIN | 0.000715 | NA | 0.0043 | 0.02 J | 0.017 J | 0.0077 J | 0.017 | 0.02 |
| ENDOSULFAN I | NA | NA | NA | 0.0024 J | 0.00086 U | 0.0013 J | NA(3) | 0.0024 |
| **INORGANICS (MG/KG)** | | | | | | | | |
| ALUMINUM | NA | 4274 | NA | 8890 J | 7600 J | 8900 J | 7600 | 8890 |
| BARIUM | NA | 3.84 | NA | 17.1 | 17 | 15.2 | 17 | 17.1 |
| BERYLLIUM | NA | 0.13 | NA | 0.30 J | 0.34 | 0.34 | 0.34 | NA(2) |
| CADMIUM | 0.68 | 0.39 | 4.21 | 20.2 | 17.7 | 21 | 17.7 | 20.2 |
| CHROMIUM | 52.3 | 13.1 | 160 | 774 | 592 | 868 | 592 | 774 |
| COBALT | NA | 0.91 | NA | 3 | 3.4 | 2.7 | 3.4 | NA(2) |
| COPPER | 18.7 | 8.44 | 108 | 102 | 146 | 115 | 146 | NA(2) |
| IRON | NA | 2684 | NA | 13600 | 13300 | 12100 | 13300 | 13600 |
| LEAD | 30.2 | 21 | 112 | 346 | 330 | 339 | 330 | 339 |
| MANGANESE | NA | 9.8 | NA | 44.9 | 65.8 | 48.8 | 65.8 | NA(2) |
| SELENIUM | NA | 0.66 | NA | 1.6 J | 1.5 J | 1.3 J | 1.5 | 1.6 |
| SILVER | 0.73 | 0.52 | 1.77 | 2 J | 3 | 1.9 J | 3 | NA(2) |
| VANADIUM | NA | 8.59 | NA | 18.4 | 15.9 | 17.3 | 15.9 | 17.3 |
| ZINC | 124 | 14.36 | 271 | 468 | 306 | 330 | 306 | 330 |
| **MISCELLANEOUS PARAMETERS** | | | | | | | | |
| TOTAL ORGANIC CARBON (MG/KG) | | | | 70000 | 60000 | 86000 | | |

Shading:
Green: Signifies non-toxic sample
Yellow: Signifies toxic sample
Blue: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a toxic sample.
Red: NOEC based on maximum detected concentration in non-toxic sample when maximum detected concentration for the parameter is in a non-toxic sample.
Black: LOEC based on lowest concentration in toxic sample above the NOEC when maximum detected concentration for the parameter is in a toxic sample.

1 - Value presented is the reference concentration because it is greater than the NOEC.
2 - Not applicable because the maximum detected concentration of the parameter was in a non-toxic sample.
3 - Not applicable because parameter was not detected in the non-toxic sample.

NOEC - No Observed Effects Concentration
LOEC - Lowest Observed Effects Concentration

TABLE 6

LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLANDS 3 AND 5A
SITE 41 - NAS PENSACOLA

| Wetland Area | LOCATION | SAMPLE DATE | PARAMETER FRACTION UNITS | ANTIMONY M MG/KG | ANTIMONY-QUAL M MG/KG | BARIUM M MG/KG | BARIUM-QUAL M MG/KG | CADMIUM M MG/KG | CADMIUM-QUAL M MG/KG | COPPER M MG/KG | COPPER-QUAL M MG/KG | IRON M MG/KG | IRON-QUAL M MG/K | LEAD M MG/KG | LEAD-QUAL M MG/KG | MANGANESE M MG/KG | MANGANESE-QUAL M MG/KG | SELENIUM M MG/KG | SELENIUM-QUAL M MG/KG | ZINC M MG/KG | ZINC-QUAL M MG/KG | CARBON DISULFIDE OV MG/KG | CARBON DISULFIDE-QUAL OV MG/KG | 4,4'-DDD PEST/PCB MG/KG | 4,4'-DDD-QUAL PEST/PCB MG/KG | 4,4'-DDE PEST/PCB MG/KG | 4,4'-DDE-QUAL PEST/PCB MG/KG | 4,4'-DDT PEST/PCB MG/KG | 4,4'-DDT-QUAL PEST/PCB MG/KG | ALPHA-BHC PEST/PCB MG/KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 001M000301 | 19940628 | 001M000301_19940628 | 8.7 | U | 8.5 | | 2.2 | | 6.2 | | 13200 | J | 36.3 | J | 35.1 | | 1.1 | U | 15.8 | | 0.014 | U | 0.019 | | 0.0034 | J | 0.0099 | | 0.0024 |
| 3 | 001M000302 | 19940628 | 001M000302_19940628 | 8.8 | U | 5.2 | | 0.99 | U | 3.1 | U | 15800 | J | 5.5 | J | 6.6 | | 1.1 | U | 6 | | 0.014 | U | 0.0062 | | 0.0025 | J | 0.0013 | J | 0.0025 |
| 3 | 001M000303 | 19940628 | 001M000303_19940628 | 8 | U | 1.6 | | 0.9 | U | 2.8 | U | 1940 | J | 7.2 | J | 2.3 | | 1 | U | 4 | | 0.013 | U | 0.40 | J | 0.12 | J | 0.22 | | 0.011 |
| 3 | 41M0301 | 19951201 | 041M030101-120195 | 0.13 | UJ | 7.4 | J | 0.52 | J | 2.2 | J | 11400 | J | 12.6 | J | 54.5 | J | 0.2 | UJ | 6.4 | J | 0.014 | U | 0.014 | J | 0.021 | J | 0.0075 | J | 0.0002 |
| 3 | 41M0302 | 19970827 | 041M030201-082797 | 4.9 | UJ | 87 | | 2 | UJ | 2 | U | 246000 | | 20.6 | | 236 | | 5.4 | | 45.8 | | 0.017 | J | 0.014 | J | 0.016 | U | 0.0037 | J | 0.0085 |
| 3 | 41M0302 | 19951201 | 041M030201-120195 | 2.4 | J | 31.7 | J | 5.8 | J | 17.8 | | 21200 | J | 101 | J | 66.1 | J | 2 | J | 32.4 | J | 0.042 | U | 0.031 | | 0.0015 | U | 0.0014 | J | 0.00074 |
| 3 | 41M0303 | 19951204 | 041M030301-120495 | 0.44 | J | 16.4 | J | 2.9 | | 4.6 | | 68000 | | 11.5 | | 39.4 | J | 1.8 | | 3.4 | | 0.10 | U | 0.0013 | J | 0.00084 | J | 0.00048 | J | 0.00045 |
| 3 | 41M0304 | 19951204 | 041M030401-120495 | 12.4 | J | 4.5 | U | 0.28 | UJ | 1.4 | J | 3820 | | 1.8 | UJ | 6.2 | | 3.3 | J | 4.2 | J | 0.02 | U | 0.0016 | J | 0.0009 | | 0.00032 | J | 0.000012 |
| 3 | 41M0305 | 19951204 | 041M030501-120495 | 44 | J | 102 | J | 1.3 | UJ | 18.8 | J | 338000 | | 14.3 | UJ | 253 | | 4.4 | UJ | 14.4 | J | 0.20 | U | 0.0035 | J | 0.0011 | U | 0.0011 | U | 0.0012 |
| 3 | 41M0306 | 19951204 | 041M030601-120495 | 0.15 | U | 5.2 | J | 1.8 | | 1.7 | U | 18000 | | 8 | | 5.7 | J | 0.44 | J | 6.3 | | 0.014 | U | 0.0077 | | 0.0025 | J | 0.0019 | J | 0.00019 |
| 3 | 41M0307 | 19970827 | 041M030701-082797 | 2.1 | UJ | 18.7 | | 9.3 | | 4 | | 67100 | | 35.6 | | 42.6 | | 2 | J | 234 | | 0.011 | U | 0.049 | | 0.011 | | 0.0093 | | 0.0036 |
| 3 | 41M0307 | 19951204 | 041M030701-120495 | 0.62 | UJ | 438 | | 72.7 | | 68.8 | | 386000 | | 18.7 | | 1270 | J | 0.93 | U | 297 | | 0.056 | U | 0.0068 | J | 0.00088 | U | 0.00094 | J | 0.000044 |
| 5A | 41M5A01 | 19951116 | 041M5A0101-111695 | 10 | J | 150 | | 11.2 | | 156 | | 9830 | | 427 | | 205 | | 1.7 | | 2290 | | 0.043 | U | 0.00064 | J | 0.00087 | J | 0.00078 | J | 0.00064 |
| 5A | 41M5A02 | 19951116 | 041M5A0201-111695 | 2.5 | J | 9.5 | J | 7.6 | | 13.1 | | 3120 | | 64.6 | | 16.6 | | 1.5 | | 39.3 | | 0.021 | U | 0.0015 | J | 0.0014 | J | 0.00032 | UJ | 0.00016 |
| 5A | 41M5A03 | 19951116 | 041M5A0301-111695 | 0.38 | U | 33.4 | J | 7.7 | | 28.5 | | 9210 | | 111 | | 55.5 | | 1.6 | | 96.9 | | 0.026 | U | 0.00084 | J | 0.00061 | UJ | 0.00061 | UJ | 0.00031 |
| 5A | 41M5A04 | 19970828 | 041M5A0401-082897 | 1.5 | UJ | 12.5 | | 0.42 | J | 21.5 | | 1090 | | 54.5 | | 15.4 | | 0.26 | U | 77.1 | | 0.0076 | U | 0.10 | | 0.057 | | 0.0072 | | 0.0026 |
| 5A | 41M5A04 | 19951116 | 041M5A0401-111695 | 4.4 | UJ | 27.2 | J | 4.2 | | 68.9 | | 2120 | | 169 | | 24.8 | | 1.8 | J | 91.7 | | 0.083 | U | 0.0023 | J | 0.0017 | J | 0.0013 | J | 0.00036 |
| 5A | 41M5A05 | 19970828 | 041M5A0501-082897 | 27.7 | J | 17.2 | | 3.2 | | 108 | | 3020 | | 258 | | 21.3 | | 0.6 | J | 394 | | 0.0079 | U | 0.10 | U | 0.10 | U | 0.10 | U | 0.054 |
| 5A | 41M5A05 | 19951127 | 041M5A0501-112795 | 4.5 | J | 50.8 | J | 10.1 | | 317 | | 6440 | | 383 | J | 73.6 | | 2.6 | J | 591 | | 0.053 | U | 0.00081 | UJ | 0.12 | | 0.005 | J | 0.00039 |
| 5A | 41M5A06 | 19970828 | 041M5A0601-082897 | 2 | J | 6.9 | | 1.2 | | 25.6 | | 546 | | 75.5 | | 8.6 | | 0.28 | U | 103 | | 0.0082 | U | 0.0013 | J | 0.0036 | J | 0.0032 | J | 0.0028 |
| 5A | 41M5A06 | 19951117 | 041M5A0601-111795 | 0.28 | J | 4.1 | J | 0.56 | | 16.2 | | 616 | | 48.6 | J | 11.8 | | 0.22 | U | 51.3 | | 0.013 | U | 0.00023 | U | 0.0012 | | 0.00023 | U | 0.00034 |
| 5A | 41M5A07 | 19951116 | 041M5A0701-111695 | 1.1 | J | 5.5 | J | 0.27 | J | 13.1 | | 1440 | | 11.5 | | 30.5 | | 0.18 | U | 54.7 | | 0.013 | U | 0.00023 | J | 0.0002 | U | 0.0002 | U | 0.00045 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOEC | 4.43 | | 87 | | 1.8 | | 25.6 | | 246000 | | 82.5 | | 236 | | 5.4 | | 103 | | 0.017 | | 0.1 | | 0.057 | | 0.02 | | |
| LOEC | 27.2 | | 87 | | 3.2 | | 108 | | 246000 | | 258 | | 236 | | 5.4 | | 234 | | 0.017 | | 0.1 | | 0.057 | | 0.02 | | |
| | Ref. used for NOEC | | No LOEC used NOEC | | Ref. used for NOEC | | | | No LOEC used NOEC | | Ref. used for NOEC | | No LOEC used NOEC | | No LOEC used NOEC | | | | No LOEC used NOEC | | No LOEC used NOEC | | No LOEC used NOEC | | Ref. used for NOEC/LOEC | | |

TABLE 6

**LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLANDS 3 AND 5A**
**SITE 41 - NAS PENSACOLA**

| Wetland Area | LOCATION | SAMPLE DATE | ALPHA-BHC-QUAL PEST/PCB MG/KG | ALPHA-CHLORDANE PEST/PCB MG/KG | ALPHA-CHLORDANE-QUAL PEST/PCB MG/KG | BETA-BHC PEST/PCB MG/KG | BETA-BHC-QUAL PEST/PCB MG/KG | DELTA-BHC PEST/PCB MG/KG | DELTA-BHC-QUAL PEST/PCB MG/KG | ENDOSULFAN I PEST/PCB MG/KG | ENDOSULFAN I-QUAL PEST/PCB MG/KG | ENDOSULFAN SULFATE PEST/PCB MG/KG | ENDOSULFAN SULFATE-QUAL PEST/PCB MG/KG | ENDRIN PEST/PCB MG/KG | ENDRIN QUAL PEST/PCB MG/KG | GAMMA-BHC (LINDANE) PEST/PCB MG/KG | GAMMA-BHC (LINDANE)-QUAL PEST/PCB MG/KG | GAMMA-CHLORDANE PEST/PCB MG/KG | GAMMA-CHLORDANE-QUAL PEST/PCB MG/KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 001M000301 | 19940628 | U | 0.00056 | J | 0.0024 | U | 0.0024 | U | 0.0024 | U | 0.0047 | U | 0.00053 | J | 0.0024 | U | 0.0024 | U |
| 3 | 001M000302 | 19940628 | U | 0.00051 | J | 0.0025 | U | 0.0025 | U | 0.0025 | U | 0.0048 | U | 0.0048 | U | 0.0025 | U | 0.0025 | U |
| 3 | 001M000303 | 19940628 | U | 0.0022 | J | 0.011 | U | 0.011 | U | 0.011 | U | 0.022 | U | 0.022 | U | 0.011 | U | 0.011 | U |
| 3 | 41M0301 | 19951201 | UJ | 0.00068 | J | 0.0002 | U | 0.00025 | J | 0.0004 | U | 0.0004 | U | 0.00098 | J | 0.0002 | U | 0.0002 | U |
| 3 | 41M0302 | 19970827 | U | 0.0085 | U | 0.0085 | U | 0.0085 | U | 0.0085 | U | 0.016 | U | 0.0028 | J | 0.0047 | U | 0.0085 | U |
| 3 | 41M0302 | 19951201 | UJ | 0.00079 | J | 0.00074 | U | 0.00074 | UJ | 0.0015 | U | 0.0015 | J | 0.0015 | U | 0.00074 | U | 0.0017 | J |
| 3 | 41M0303 | 19951204 | J | 0.000022 | UJ | 0.0007 | J | 0.000022 | UJ | 0.000022 | UJ | 0.00045 | UJ | 0 0018 | J | 0.000022 | UJ | 0.000022 | UJ |
| 3 | 41M0304 | 19951204 | UJ | 0.00017 | J | 0.000012 | U | 0.00018 | J | 0.000012 | U | 0.00024 | U | 0.00024 | U | 0.000012 | U | 0.00011 | |
| 3 | 41M0305 | 19951204 | J | 0.000053 | U | 0.000053 | U | 0.000053 | UJ | 0.000053 | U | 0.0011 | U | 0.0013 | J | 0.000053 | U | 0.000053 | U |
| 3 | 41M0306 | 19951204 | J | 0.00069 | J | 0.000013 | U | 0.000013 | UJ | 0.000013 | U | 0.00025 | U | 0.00025 | U | 0.000013 | U | 0.00054 | |
| 3 | 41M0307 | 19970827 | U | 0.0036 | U | 0.0036 | U | 0.0036 | U | 0.0036 | U | 0.0072 | J | 0.007 | U | 0.0036 | U | 0.00074 | J |
| 3 | 41M0307 | 19951204 | UJ | 0.00045 | J | 0.000044 | U | 0.000044 | UJ | 0.000044 | U | 0.0017 | J | 0.00088 | U | 0.000044 | U | 0.000044 | U |
| 5A | 41M5A01 | 19951116 | J | 0.00033 | J | 0.0003 | UJ | 0.0003 | UJ | 0 0003 | UJ | 0.00059 | UJ | 0.00059 | UJ | 0.0003 | UJ | 0.0003 | UJ |
| 5A | 41M5A02 | 19951116 | UJ | 0.00016 | UJ | 0.00016 | UJ | 0.00016 | UJ | 0.00019 | U | 0.00032 | UJ | 0.00032 | UJ | 0.00016 | UJ | 0.00016 | UJ |
| 5A | 41M5A03 | 19951116 | UJ | 0.00031 | UJ | 0.00031 | UJ | 0.00031 | UJ | 0.00031 | UJ | 0.00061 | UJ | 0.00061 | UJ | 0.00031 | UJ | 0.00031 | UJ |
| 5A | 41M5A04 | 19970828 | U | 0.0045 | | 0.0026 | U | 0.0026 | U | 0.0052 | | 0.0023 | J | 0.00069 | U | 0.00024 | J | 0.0079 | J |
| 5A | 41M5A04 | 19951116 | UJ | 0.00036 | UJ | 0.00036 | UJ | 0.00036 | UJ | 0.00049 | U | 0.00072 | UJ | 0.00072 | UJ | 0.00036 | UJ | 0.00036 | UJ |
| 5A | 41M5A05 | 19970828 | U | 0.054 | U | 0.054 | U | 0.054 | U | 0.054 | U | 0.10 | U | 0.0024 | U | 0.054 | U | 0.054 | U |
| 5A | 41M5A05 | 19951127 | UJ | 0.0016 | J | 0.00039 | UJ | 0.00039 | UJ | 0.00081 | UJ | 0.00081 | UJ | 0.0011 | J | 0.00039 | UJ | 0.0013 | J |
| 5A | 41M5A06 | 19970828 | U | 0.00026 | U | 0.0028 | U | 0.0028 | U | 0.0003 | U | 0.00066 | J | 0.0011 | J | 0.0028 | U | 0.00014 | U |
| 5A | 41M5A06 | 19951117 | J | 0.00011 | U | 0.00011 | U | 0.00011 | U | 0.00023 | U | 0.00023 | U | 0.00023 | U | 0.00011 | U | 0.00011 | U |
| 5A | 41M5A07 | 19951116 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.0002 | U | 0.0002 | U | 0.0001 | U | 0.00023 | J |
| | | | | 0.0045 | | | | | | 0.0052 | | 0.0023 | | 0.0033 | | 0.00032 | | 0.0079 | |
| | | | | 0.0045 | | | | | | 0.0052 | | 0.0023 | | 0.0033 | | 0.00032 | | 0.0079 | |
| | | | | No LOEC used NOEC | | | | | | No LOEC used NOEC | | No LOEC used NOEC | | Screening Level for NOEC/LOEC | | Screening Level for NOEC/LOEC | | No LOEC used NOEC | |

**TABLE 7**

**LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLANDS 16 AND 18B**
**SITE 41 - NAS PENSACOLA**

| Wetland Area | LOCATION | SAMPLE DATE | PARAMETER FRACTION UNITS | ALUMINUM M MG/KG | ALUMINUM-QUAL M MG/KG | ARSENIC M MG/KG | ARSENIC-QUAL M MG/KG | BARIUM M MG/KG | BARIUM-QUAL M MG/KG | BERYLLIUM M MG/KG | BERYLLIUM-QUAL M MG/KG | IRON M MG/KG | IRON-QUAL M MG/KG | LEAD M MG/KG | LEAD-QUAL M MG/KG | MANGANESE M MG/KG | MANGANESE-QUAL M MG/KG | SELENIUM M MG/KG | SELENIUM-QUAL M MG/KG | VANADIUM M MG/KG | VANADIUM-QUAL M MG/KG | TOTAL ORGANIC CARBON MISC MG/KG | TOTAL ORGANIC CARBON-QUAL MISC MG/KG | 2,2'-OXYBIS(1-CHLOROPROPANE) OS MG/KG | 2,2'-OXYBIS(1-CHLOROPROPANE)-QUAL OS MG/KG | 2,4-DIMETHYLPHENOL OS MG/KG | 2,4-DIMETHYLPHENOL-QUAL OS MG/KG | 2-METHYLPHENOL OS MG/KG | 2-METHYLPHENOL-QUAL OS MG/KG | 4-METHYLPHENOL OS MG/KG | 4-METHYLPHENOL-QUAL OS MG/KG | PHENOL OS MG/KG | PHENOL-QUAL OS MG/KG | 4,4'-DDD PEST/PCB MG/KG | 4,4'-DDD-QUAL PEST/PCB MG/KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 001M0016 | 19940629 | 001M001601_19940629 | 5120 | J | 1.4 | J | 4.2 | | 0.4 | U | 4680 | J | 4.1 | J | 14.3 | | 1.4 | U | 6.9 | | | | 0.62 | U | 0.62 | U | 0.62 | U | 0.62 | U | 0.62 | U | 0.00041 | J |
| 16 | 41M1601 | 19951207 | 041M160101-120795 | 255 | | 0.72 | | 0.69 | U | 0.07 | U | 1330 | | 2.1 | | 1.4 | | 0.19 | U | 1.2 | J | 1440 | | 0.40 | U | 0.40 | U | 0.40 | U | 0.40 | U | 0.40 | U | 0.00027 | J |
| 16 | 41M1602 | 19951207 | 041M160201-120795 | 1370 | | 0.47 | UJ | 8.4 | U | 0.23 | U | 5280 | | 11 | UJ | 20.7 | | 0.93 | UJ | 10.6 | J | 12600 | | 0.64 | U | 0.64 | U | 0.64 | U | 0.64 | U | 0.64 | U | 0.0015 | J |
| 16 | 41M1603 | 19970904 | 041M160301-090497 | 5320 | J | 5.5 | | 4.7 | | 0.26 | | 17000 | | 29.4 | | 39 | | 1 | J | 15.3 | | 17000 | | 0.87 | UJ | 0.87 | U | 0.87 | U | | | 0.87 | U | 0.0069 | J |
| 16 | 41M1603 | 19951207 | 041M160301-120795 | 8880 | | 10.9 | | 8.1 | J | 0.47 | J | 39500 | | 182 | | 211 | | 0.84 | J | 34 | | 55300 | | 1.7 | U | 1.7 | U | 1.7 | U | 1.7 | U | 1.7 | U | 0.0048 | J |
| 18B | 41M18B1 | 19951214 | 041M18B101-121495 | 11100 | | 83.8 | | 10.9 | J | 0.73 | J | 128000 | | 111 | | 46.7 | | 2.2 | | 50.9 | | 118000 | | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 0.28 | |
| 18A | 41M18B1 | 19970829 | 041M18B101-082997 | 605 | | 13.8 | | 1.8 | J | 0.07 | J | 20800 | | 5.9 | | 10.8 | | 0.74 | J | 6.3 | | 9000 | | 0.67 | U | 0.67 | U | 0.67 | U | | | 0.67 | U | 0.036 | |
| | | | NOEC | 5320 | | 13.8 | | 4.7 | | 0.26 | | 20800 | | 30.2 | | 39 | | 1 | | 15.3 | | | | | | | | | | | | | | 0.05 | |
| | | | | | | | | | | | | | | Used Screening Level | | | | | | | | | | | | | | | | | | | | reference concentration | |

TABLE 7

LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLANDS 16 AND 18B
SITE 41 - NAS PENSACOLA

| Wetland Are | LOCATION | SAMPLE DATE | PARAMETER FRACTION UNITS | 4,4'-DDT PEST/PCB MG/KG | 4,4'-DDT-QUAL PEST/PCB MG/KG | ALDRIN PEST/PCB MG/KG | ALDRIN-QUAL PEST/PCB MG/KG | ALPHA-BHC PEST/PCB MG/KG | ALPHA-BHC-QUAL PEST/PCB MG/KG | ALPHA-CHLORDANE PEST/PCB MG/KG | ALPHA-CHLORDANE-QUAL PEST/PCB MG/KG | BETA-BHC PEST/PCB MG/KG | BETA-BHC-QUAL PEST/PCB MG/KG | DELTA-BHC PEST/PCB MG/KG | DELTA-BHC-QUAL PEST/PCB MG/KG | ENDOSULFAN I PEST/PCB MG/KG | ENDOSULFAN I-QUAL PEST/PCB MG/KG | ENDRIN PEST/PCB MG/KG | ENDRIN-QUAL PEST/PCB MG/KG | ENDRIN ALDEHYDE PEST/PCB MG/KG | ENDRIN ALDEHYDE-QUAL PEST/PCB MG/KG | ENDRIN KETONE PEST/PCB MG/KG | ENDRIN KETONE-QUAL PEST/PCB MG/KG | GAMMA-BHC (LINDANE) PEST/PCB MG/KG | GAMMA-BHC (LINDANE)-QUAL PEST/PCB MG/KG | GAMMA-CHLORDANE PEST/PCB MG/KG | GAMMA-CHLORDANE-QUAL PEST/PCB MG/KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 001M0016 | 19940629 | 001M001601_19940629 | 0.0061 | U | 0.0032 | U | 0.0032 | U | 0.0032 | U | 0.0032 | U | 0.0032 | U | 0.0032 | U | 0.0061 | U | 0.0061 | U | 0.0061 | U | 0.0032 | U | 0.0032 | U |
| 16 | 41M1601 | 19951207 | 041M160101-120795 | 0.00021 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.0001 | U | 0.00021 | U | 0.00021 | U | 0.00021 | U | 0.0001 | U | 0.0001 | U |
| 16 | 41M1602 | 19951207 | 041M160201-120795 | 0.00033 | U | 0.00016 | U | 0.00016 | U | 0.00016 | U | 0.00016 | U | 0.00016 | U | 0.00016 | U | 0.00033 | U | 0.00033 | U | 0.00033 | U | 0.00016 | U | 0.00016 | U |
| 16 | 41M1603 | 19970904 | 041M160301-090497 | 0.016 | | 0.0045 | U | 0.0045 | U | 0.0045 | U | 0.0045 | U | 0.0045 | U | 0.0045 | U | 0.0013 | J | 0.0087 | U | 0.0087 | U | 0.0045 | U | 0.0045 | U |
| 16 | 41M1603 | 19951207 | 041M160301-120795 | 0.0028 | J | 0.00043 | U | 0.00043 | U | 0.00047 | J | 0.00043 | U | 0.00043 | U | 0.00043 | U | 0.00088 | U | 0.00088 | U | 0.00088 | U | 0.00043 | U | 0.00043 | U |
| 18B | 41M18B1 | 19951214 | 041M18B101-121495 | 1.8 | | 0.024 | U | 0.024 | UJ | 0.024 | U | 0.024 | U | 0.024 | U | 0.024 | U | 0.05 | U | 0.05 | U | 0.05 | U | 0.024 | U | 0.024 | U |
| 18A | 41M18B1 | 19970829 | 041M18B101-082997 | 0.11 | | 0.0035 | U | 0.0035 | U | 0.0035 | U | 0.0035 | U | 0.0035 | U | 0.0035 | U | 0.0067 | 0.0067 | U | 0.0067 | U | U | 0.0035 | U | 0.0035 | U |
| | | | NOEC | 0.11 | | | | | | | | | | | | | | 0.0033 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | Used Screening Level | | | | | | | | | |

TABLE 7

LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLANDS 16 AND 18B
SITE 41 - NAS PENSACOLA

| Wetland Are | LOCATION | SAMPLE DATE | PARAMETER FRACTION UNITS | HEPTACHLOR PEST/PCB MG/KG | HEPTACHLOR EPOXIDE PEST/PCB MG/KG |
|---|---|---|---|---|---|
| 16 | 001M0016 | 19940629 | 001M001601_19940629 | 0.0032 | 0.0032 |
| 16 | 41M1601 | 19951207 | 041M160101-120795 | 0.0001 | 0.0001 |
| 16 | 41M1602 | 19951207 | 041M160201-120795 | 0.00016 | 0.00016 |
| 16 | 41M1603 | 19970904 | 041M160301-090497 | 0.0045 | 0.0045 |
| 16 | 41M1603 | 19951207 | 041M160301-120795 | 0.00043 | 0.00043 |
| 18B | 41M18B1 | 19951214 | 041M18B101-121495 | 0.024 | 0.024 |
| 18A | 41M18B1 | 19970829 | 041M18B101-082997 | 0.0035 | 0.0035 |

| | | |
|---|---|---|
| NOEC | | |
| | | |

TABLE 8

LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLAND 64
SITE 41 - NAS PENSACOLA

| Wetland Area | LOCATION | SAMPLE | PARAMETER | ALUMINUM | ALUMINUM-QUAL | BARIUM | BARIUM-QUAL | BERYLL | BERYLLIUM-QUAL | CADMIUM | CADMIUM-QUAL | CHROMIUM | CHROMIUM-QUAL | COBALT | COBALT-QUAL | COPPER | COPPER-QUAL | IRON | IRON-QUAL | LEAD | LEAD-QUAL | MANGANESE | MANGANESE-QUAL | SELENIUM | SELENIUM-QUAL | SILVER | SILVER-QUAL | VANADIUM | VANADIUM-QUAL | ZINC | ZINC-QUAL | BIS(2-ETHYLHEXYL)PHTHALATE | BIS(2-ETHYLHEXYL)PHTHALATE-QUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 41M6401 | 19960209 | 041M640101-020996 | 2300 | | 4.4 | J | 0.07 | U | 1.6 | | 11.1 | | 0.36 | J | 4 3 | | 1130 | | 38 | | 7.5 | | 0.29 | U | 0.36 | U | 3.4 | J | 22.5 | | 0.45 | U |
| 64 | 41M6402 | 19951115 | 041M640201-111595 | 3770 | J | 7.2 | J | 0.2 | J | 18.9 | | 1600 | | 1.4 | J | 39.8 | J | 7340 | J | 346 | J | 24.5 | | 0.67 | J | 0.42 | J | 6.2 | | 145 | J | 26 | U |
| 64 | 41M6402 | 20010801 | 041M640202-080101 | 5700 | | 11 | | 0.22 | J | 14 | | 500 | | 1.4 | J | 80 | | 12000 | | 210 | | 34 | | 1.1 | U | 1.5 | J | 14 | | 250 | | 0.98 | J |
| 64 | 41M6403 | 19951115 | 041M640301-111595 | 11200 | J | 1280 | | 0.57 | J | 38.6 | | 1800 | | 6.1 | J | 255 | J | 25900 | J | 634 | J | 125 | | 3.1 | J | 5.1 | J | 28 9 | | 481 | J | 2.7 | U |
| 64 | 41M6403 | 20010801 | 041M640302-080101 | 2300 | | 5.5 | | 0.15 | J | 11 | | 310 | | 1 | J | 60 | | 7100 | | 140 | | 28 | | 0.78 | U | 1.4 | J | 7.7 | | 200 | | 4.3 | U |
| 64 | 41M6404 | 19960209 | 041M640401-020996 | 5350 | | 7.7 | J | 0.44 | U | 2.8 | | 1610 | | 0.87 | U | 23.8 | | 2790 | | 146 | | 15 | | 1.7 | U | 2.2 | U | 20.9 | J | 31.8 | | 3.7 | U |
| 64 | 41M6404 | 19970904 | 041M640401-090497 | 8890 | J | 17.1 | | 0.3 | J | 20.2 | | 774 | | 3 | | 102 | | 13600 | | 346 | | 44 9 | | 1 6 | J | 2 | J | 18.4 | | 468 | | 3.3 | |
| 64 | 41M6405 | 19970904 | 041M640501-090497 | 7600 | J | 17 | | 0.34 | | 17.7 | | 592 | | 3.4 | | 146 | | 13300 | | 330 | | 65.8 | | 1.5 | J | 3 | | 15.9 | | 306 | | 2 | |
| 64 | 41M6405 | 19951115 | 041M640501-111595 | 3710 | J | 15.5 | J | 0.25 | U | 18.5 | | 466 | | 2.2 | J | 88.6 | J | 10500 | J | 262 | J | 43.6 | | 0.88 | J | 1 | UJ | 9.8 | J | 290 | J | 2.6 | U |
| 64 | 41M6405 | 20010802 | 041M640502-080201 | 8600 | | 18 | | 0.51 | J | 23 | | 700 | | 4.8 | | 200 | | 19000 | | 430 | | 96 | | 0.99 | U | 4 | | 23 | | 380 | | 1.5 | J |
| 64 | 41M6406 | 19970903 | 041M640601-090397 | 8900 | J | 15.2 | | 0.34 | | 21 | | 868 | | 2.7 | | 115 | | 12100 | | 339 | | 48.8 | | 1.3 | J | 1 9 | J | 17 3 | | 330 | | 3 9 | |
| 64 | 41M6406 | 19951115 | 041M640601-111595 | 2410 | J | 4.3 | J | 0.11 | J | 8.8 | | 324 | | 0.91 | J | 29.4 | J | 3810 | J | 156 | J | 15.2 | | 0.34 | J | 0.37 | J | 4.3 | | 105 | J | 27 | U |
| 64 | 41M6406 | 20010801 | 041M640602-080101 | 3000 | | 7.5 | | 0.21 | J | 8.6 | | 370 | | 1.2 | J | 58 | | 8000 | | 150 | | 30 | | 0.8 | U | 1.3 | J | 10 | | 140 | | 1.3 | J |
| 64 | 41M6407 | 19951115 | 041M640701-111595 | 334 | J | 5.6 | J | 0.07 | U | 0.53 | | 19 | | 0.23 | J | 17.6 | J | 967 | J | 12.2 | J | 3.2 | | 0.2 | U | 0.26 | UJ | 0.83 | J | 14.7 | J | 0.44 | U |
| 64 | 41M6407 | 20010801 | 041M640702-080101 | 130 | | 6.9 | | 0.01 | U | 0.07 | J | 7.8 | | 0.081 | U | 12 | | 190 | | 9.7 | | 0.74 | J | 0.37 | U | 0.071 | U | 0.27 | J | 3 | J | 0.4 | U |
| 64 | 41M6408 | 19960201 | 041M640801-020196 | 846 | | 1.1 | J | 0.07 | U | 1.2 | | 32.3 | | 0.15 | J | 6.9 | | 1190 | | 17.6 | | 9.4 | | 0.29 | U | 0.36 | U | 1.7 | J | 21.1 | | 0.22 | J |
| 64 | 41M6409 | 19951115 | 041M640901-111595 | 221 | J | 0.37 | J | 0.06 | U | 0.38 | | 9.4 | | 0.19 | U | 1.8 | J | 346 | J | 6.1 | J | 1.3 | | 0.19 | U | 0.25 | UJ | 0 44 | J | 4.2 | J | 0.41 | U |
| 64 | 41M6410 | 19951116 | 041M641001-111695 | 25600 | | 24.9 | J | 1.1 | J | 23.2 | | 806 | | 4.1 | J | 140 | | 34600 | | 324 | | 171 | | 2.1 | | 1.2 | U | 40.2 | | 377 | | 3.5 | U |
| 64 | 41M6411 | 19951116 | 041M641101-111695 | 17300 | | 15.4 | J | 0.77 | J | 20.1 | | 659 | | 3.3 | J | 66.4 | | 24100 | | 221 | | 168 | | 1.5 | | 0.8 | U | 28.2 | | 192 | | 2.5 | U |
| 64 | 41M6411 | 20010802 | 041M641102-080201 | 18000 | | 18 | | 1.1 | J | 15 | | 630 | | 4.4 | J | 120 | | 33000 | | 210 | | 230 | | 2.2 | U | 1.8 | J | 37 | | 290 | | 13 | U |
| 64 | 41M6412 | 19951115 | 041M641201-111595 | 216 | J | 0.35 | J | 0.06 | U | 0.27 | J | 7.2 | | 0.18 | U | 1.9 | J | 341 | J | 3.6 | J | 1.2 | | 0.18 | U | 0.24 | UJ | 0.46 | J | 4.2 | J | 0.41 | U |
| 64 | 41M6413 | 19951116 | 041M641301-111695 | 23600 | | 20.5 | J | 1.1 | J | 16.9 | | 699 | | 3.2 | J | 102 | | 32900 | | 231 | | 183 | | 1.2 | J | 1.3 | U | 36.7 | | 268 | | 1.9 | U |
| 64 | 41M6414 | 19951116 | 041M641401-111695 | 29000 | J | 42.9 | J | 1.1 | J | 7.2 | J | 577 | | 9.4 | J | 76.9 | | 32400 | J | 179 | J | 127 | J | 6.4 | UJ | 2.2 | UR | 60.7 | | 175 | J | 2 | U |
| 64 | 41M6415 | 19951115 | 041M641501-111595 | 837 | J | 2.3 | U | 0.17 | UJ | 0.35 | UJ | 8.1 | U | 0.35 | UJ | 2.8 | J | 502 | J | 2.3 | J | 2.7 | J | 4.3 | UJ | 0.87 | UR | 1.2 | J | 3.2 | J | 0.43 | U |
| 64 | 41M6416 | 19951116 | 041M641601-111695 | 26800 | | 23.6 | J | 1.3 | J | 19 | | 756 | | 3.5 | J | 119 | | 38200 | | 249 | | 203 | | 2.4 | | 1.1 | U | 43.4 | | 300 | | 1.9 | U |
| 64 | 41M6417 | 19951116 | 041M641701-111695 | 4000 | | 4 | J | 0.18 | J | 2.4 | | 78.2 | | 0.68 | J | 16.3 | | 5970 | | 31.9 | | 46.9 | | 0.35 | J | 0.37 | U | 7.3 | | 52.4 | | 0.61 | U |
| 64 | 41M6418 | 19960206 | 041M641801-020696 | 225 | | 0.38 | J | 0.06 | U | 0 19 | J | 5.2 | | 0.13 | J | 1.5 | U | 339 | | 2.6 | | 1.2 | | 0.26 | U | 0.32 | U | 0.61 | J | 2.6 | | 0.033 | J |
| 64 | 41M6419 | 19960201 | 041M641901-020196 | 26100 | | 22 | J | 1.3 | J | 14.8 | | 638 | | 4.7 | J | 121 | | 35000 | | 224 | | 195 | | 1.7 | | 1.7 | U | 41.3 | | 308 | | 0.53 | J |
| 64 | 41M6420 | 19951116 | 041M642001-111695 | 951 | | 1 | J | 0.07 | U | 0.56 | | 13.8 | | 0.2 | UJ | 4.3 | | 1370 | | 7.5 | | 11.1 | | 0.2 | U | 0.26 | U | 2.1 | J | 15.8 | | 0.42 | U |
| 64 | 41M6421 | 19951116 | 041M642101-111695 | 75.5 | | 0.28 | U | 0.07 | U | 0.21 | U | 1.2 | | 0.21 | UJ | 0.74 | J | 77.2 | | 0.65 | | 0.61 | J | 0.21 | U | 0.27 | U | 0.42 | J | 2.2 | | 0.41 | U |
| 64 | 41M6422 | 19951117 | 041M642201-111795 | 793 | | 2 | J | 0.13 | U | 1.6 | | 21.3 | | 0.38 | U | 7.2 | | 689 | | 36.3 | J | 3 2 | | 0.38 | U | 0.72 | J | 1 5 | U | 21.3 | | 0.46 | U |
| 64 | 41M6423 | 19951117 | 041M642301-111795 | 1020 | | 1.2 | J | 0.07 | U | 0.44 | | 19.4 | | 0.21 | U | 4.4 | | 1740 | | 8.8 | J | 16.1 | | 0.21 | U | 0.29 | UJ | 2 4 | J | 18.8 | | 0.42 | U |
| 64 | 41M6424 | 19951117 | 041M642401-111795 | 28 9 | | 0.16 | U | 0 07 | U | 0.2 | U | 0.55 | J | 0.2 | U | 0.57 | U | 26 | | 0.29 | UJ | 0.12 | J | 0.2 | U | 0.27 | UJ | 0.21 | U | 1.4 | U | 0.42 | U |
| 64 | 41M6424 | 20010801 | 041M642402-080101 | 59 | | 0.17 | J | 0 013 | U | 0.063 | UJ | 1 | J | 0.1 | U | 1 | U | 48 | | 0.38 | J | 0.31 | J | 0 45 | U | 0.088 | U | 0.12 | | 0.13 | UJ | 0.41 | U |
| | | | | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | |
| | | | NOEC | 7600 | | 17 | | 0.34 | | 17.7 | | 592 | | 3.4 | | 146 | | 13300 | | 330 | | 65.8 | | 1.5 | | 3 | | 15.9 | | 306 | | 2 | |
| | | | LOEC | 8890 | | 17 1 | | 0.34 | | 20.2 | | 774 | | 3.4 | | 146 | | 13600 | | 339 | | 65.8 | | 1.6 | | 3 | | 17.3 | | 330 | | 3 3 | |
| | | | | | | | | No LOEC used NOEC | | | | | | No LOEC used NOEC | | No LOEC used NOEC | | | | | | No LOEC used NOEC | | | | No LOEC used NOEC | | | | | | | |

TABLE 8

LOCATIONS WITH EXCEEDENCES OF LOECS OR NOECS FOR WETLAND 64
SITE 41 - NAS PENSACOLA

| Wetland Area | LOCATION | SAMPLE | PARAMETER | CARBAZOLE | CARBAZOLE-QUAL | DIBENZOFURAN | DIBENZOFURAN-QUAL | 4,4'-DDD | 4,4'-DDD-QUAL | 4,4'-DDE | 4,4'-DDE-QUAL | 4,4'-DDT | 4,4'-DDT-QUAL | ALPHA-BHC | ALPHA-BHC-QUAL | AROCLOR-1260 | AROCLOR-1260-QUAL | BETA-BHC | BETA-BHC-QUAL | DELTA-BHC | DELTA-BHC-QUAL | DIELDRIN | DIELDRIN-QUAL | ENDOSULFAN I | ENDOSULFAN I-QUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 41M6401 | 19960209 | 041M640101-020996 | 0.23 | J | 0.072 | J | 0.012 | J | 0.0037 | J | 0.014 | J | 0.00012 | J | 0.012 | J | 0.00011 | U | 0.00011 | U | 0.00023 | U | 0.00011 | U |
| 64 | 41M6402 | 19951115 | 041M640201-111595 | 26 | U | 26 | U | 0.14 | | 0.072 | J | 0.0033 | U | 0.0016 | U | 0.065 | U | 0.0016 | U | 0.0016 | U | 0.0033 | J | 0.0033 | U |
| 64 | 41M6402 | 20010801 | 041M640202-080101 | | | 6.8 | U | 0.03 | U | 0.043 | J | 0.068 | U | 0.035 | U | 0.68 | U | 0.035 | U | 0.0044 | J | 0.068 | U | 0.035 | U |
| 64 | 41M6403 | 19951115 | 041M640301-111595 | 2.7 | U | 2.7 | U | 0.044 | J | 0.078 | | 0.014 | J | 0.0034 | U | 0.14 | U | 0.0034 | U | 0.0034 | U | 0.007 | U | 0.007 | U |
| 64 | 41M6403 | 20010801 | 041M640302-080101 | | | 4.3 | U | 0.014 | U | 0.0084 | J | 0.043 | UJ | 0.022 | UJ | 0.43 | UJ | 0.022 | UJ | 0.022 | UJ | 0.043 | UJ | 0.022 | UJ |
| 64 | 41M6404 | 19960209 | 041M640401-020996 | 3.7 | U | 3.7 | U | 0.016 | | 0.018 | | 0.0019 | U | 0.00092 | U | 0.023 | J | 0.00092 | U | 0.00092 | U | 0.0019 | U | 0.00092 | U |
| 64 | 41M6404 | 19970904 | 041M640401-090497 | 0.32 | J | 1.3 | U | 0.089 | | 0.089 | | 0.018 | J | 0.014 | U | 0.3 | | 0.014 | U | 0.00069 | NJ | 0.02 | J | 0.0024 | J |
| 64 | 41M6405 | 19970904 | 041M640501-090497 | 0.35 | J | 0.13 | J | 0.03 | | 0.033 | | 0.0077 | U | 0.0089 | U | 0.28 | | 0.0089 | U | 0.0089 | U | 0.017 | J | 0.00086 | U |
| 64 | 41M6405 | 19951115 | 041M640501-111595 | 0.4 | J | 0.085 | J | 0.029 | J | 0.027 | J | 0.00074 | J | 0.00059 | J | 0.0068 | U | 0.00017 | U | 0.00017 | U | 0.00079 | J | 0.00035 | U |
| 64 | 41M6405 | 20010802 | 041M640502-080201 | | | 6 | U | 0.023 | U | 0.032 | J | 0.06 | U | 0.031 | U | 0.6 | U | 0.031 | U | 0.0036 | J | 0.06 | U | 0.031 | U |
| 64 | 41M6406 | 19970903 | 041M640601-090397 | 0.8 | J | 0.35 | J | 0.053 | | 0.044 | | 0.019 | | 0.0057 | U | 0.18 | | 0.0057 | U | 0.00094 | NJ | 0.0077 | J | 0.0013 | J |
| 64 | 41M6406 | 19951115 | 041M640601-111595 | 27 | U | 27 | U | 0.03 | | 0.016 | J | 0.0014 | J | 0.00069 | U | 0.027 | U | 0.00069 | U | 0.00069 | U | 0.0014 | U | 0.0014 | U |
| 64 | 41M6406 | 20010801 | 041M640602-080101 | | | 4.8 | U | 0.1 | J | 0.03 | J | 0.048 | U | 0.025 | U | 0.48 | U | 0.025 | U | 0.0021 | J | 0.048 | U | 0.025 | U |
| 64 | 41M6407 | 19951115 | 041M640701-111595 | 0.44 | U | 0.44 | U | 0.012 | | 0.00061 | | 0.00023 | U | 0.00022 | J | 0.0044 | U | 0.00011 | U | 0.00011 | U | 0.00023 | U | 0.00023 | U |
| 64 | 41M6407 | 20010801 | 041M640702-080101 | | | 0.4 | U | 0.004 | U | 0.004 | U | 0.004 | U | 0.0021 | U | 0.04 | U | 0.0021 | U | 0.00066 | J | 0.004 | U | 0.0021 | U |
| 64 | 41M6408 | 19960201 | 041M640801-020196 | 0.51 | U | 0.51 | U | 0.0022 | | 0.0024 | | 0.00066 | J | 0.00013 | U | 0.011 | | 0.00013 | U | 0.00013 | U | 0.00026 | U | 0.00013 | U |
| 64 | 41M6409 | 19951115 | 041M640901-111595 | 0.41 | U | 0.41 | U | 0.00031 | J | 0.00035 | | 0.00021 | U | 0.00037 | J | 0.0041 | U | 0.0001 | U | 0.0001 | U | 0.00021 | U | 0.00021 | U |
| 64 | 41M6410 | 19951116 | 041M641001-111695 | 1.9 | U | 1.9 | U | 0.0022 | J | 0.0025 | J | 0.00097 | U | 0.00049 | U | 0.024 | J | 0.00049 | U | 0.00049 | U | 0.0015 | J | 0.00049 | U |
| 64 | 41M6411 | 19951116 | 041M641101-111695 | 1.2 | U | 1.2 | U | 0.00068 | J | 0.002 | J | 0.00059 | U | 0.00045 | U | 0.029 | | 0.0003 | U | 0.0003 | U | 0.0017 | J | 0.0003 | U |
| 64 | 41M6411 | 20010802 | 041M641102-080201 | | | 13 | U | 0.13 | UJ | 0.13 | UJ | 0.13 | UJ | 0.068 | UJ | 1.3 | UJ | 0.068 | UJ | 0.0069 | J | 0.13 | UJ | 0.068 | UJ |
| 64 | 41M6412 | 19951115 | 041M641201-111595 | 0.41 | U | 0.41 | U | 0.00026 | J | 0.00021 | U | 0.00021 | U | 0.00019 | J | 0.0041 | U | 0.0001 | U | 0.0001 | U | 0.00021 | U | 0.00021 | U |
| 64 | 41M6413 | 19951116 | 041M641301-111695 | 1.8 | U | 1.8 | U | 0.00092 | UJ | 0.0014 | J | 0.00092 | UJ | 0.00066 | J | 0.027 | J | 0.00046 | UJ | 0.00046 | UJ | 0.0014 | J | 0.00046 | UJ |
| 64 | 41M6414 | 19951116 | 041M641401-111695 | 2 | U | 2 | U | 0.001 | U | 0.001 | U | 0.001 | U | 0.00094 | J | 0.016 | J | 0.00052 | U | 0.00052 | U | 0.001 | U | 0.00076 | J |
| 64 | 41M6415 | 19951115 | 041M641501-111595 | 0.43 | UJ | 0.43 | U | 0.0002 | J | 0.00043 | J | 0.0006 | J | 0.00011 | UJ | 0.0043 | UJ | 0.00011 | UJ | 0.00011 | UJ | 0.00022 | UJ | 0.00022 | UJ |
| 64 | 41M6416 | 19951116 | 041M641601-111695 | 1.9 | U | 1.9 | U | 0.00097 | U | 0.00097 | U | 0.00097 | U | 0.00064 | J | 0.016 | J | 0.00049 | U | 0.00049 | U | 0.00097 | U | 0.00054 | U |
| 64 | 41M6417 | 19951116 | 041M641701-111695 | 0.61 | U | 0.61 | U | 0.00031 | U | 0.00031 | U | 0.00031 | U | 0.00036 | U | 0.0048 | J | 0.00015 | U | 0.00015 | U | 0.00031 | U | 0.0002 | U |
| 64 | 41M6418 | 19960206 | 041M641801-020696 | 0.43 | U | 0.43 | U | 0.00022 | U | 0.00022 | U | 0.00022 | U | 0.00011 | U | 0.0013 | J | 0.00011 | U | 0.00011 | U | 0.00022 | U | 0.00011 | U |
| 64 | 41M6419 | 19960201 | 041M641901-020196 | 1.9 | U | 1.9 | U | 0.0011 | J | 0.0013 | J | 0.0011 | U | 0.00052 | U | 0.05 | J | 0.00052 | U | 0.00052 | U | 0.0011 | U | 0.00052 | U |
| 64 | 41M6420 | 19951116 | 041M642001-111695 | 0.42 | U | 0.42 | U | 0.00021 | U | 0.00021 | U | 0.00021 | U | 0.0002 | U | 0.0019 | J | 0.00011 | U | 0.00011 | U | 0.00021 | U | 0.00019 | U |
| 64 | 41M6421 | 19951116 | 041M642101-111695 | 0.41 | U | 0.41 | U | 0.00021 | U | 0.00021 | U | 0.00021 | U | 0.00014 | U | 0.0021 | U | 0.0001 | U | 0.0001 | U | 0.00021 | U | 0.0002 | U |
| 64 | 41M6422 | 19951117 | 041M642201-111795 | 0.46 | UJ | 0.46 | U | 0.00024 | U | 0.00024 | U | 0.00024 | U | 0.00012 | U | 0.0046 | U | 0.00012 | U | 0.00012 | U | 0.00024 | U | 0.00024 | U |
| 64 | 41M6423 | 19951117 | 041M642301-111795 | 0.42 | U | 0.42 | U | 0.00022 | U | 0.00022 | U | 0.00022 | U | 0.00011 | U | 0.0042 | U | 0.00011 | U | 0.00011 | U | 0.00022 | U | 0.00022 | U |
| 64 | 41M6424 | 19951117 | 041M642401-111795 | 0.42 | UJ | 0.42 | U | 0.00023 | UJ | 0.00023 | UJ | 0.00023 | UJ | 0.00015 | J | 0.0044 | UJ | 0.00011 | UJ | 0.00011 | UJ | 0.00023 | UJ | 0.00023 | UJ |
| 64 | 41M6424 | 20010801 | 041M642402-080101 | | | 0.41 | U | 0.0041 | UJ | 0.0041 | UJ | 0.0041 | UJ | 0.0021 | UJ | 0.041 | UJ | 0.0021 | UJ | 0.0021 | UJ | 0.0041 | UJ | 0.0021 | UJ |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOEC | 0.35 | | 0.13 | | 0.05 | | | | | | | | 0.28 | | | | | | 0.017 | | | |
| LOEC | 0.8 | | 0.35 | | 0.089 | | 0.04 | | 0.02 | | 0.00099 | | 0.3 | | 0.00099 | | 0.00099 | | 0.02 | | 0.0024 | |
| | | | | | Ref. used for NOEC | | reference concentration | | reference concentration | | refinement value | | | | refinement value | | refinement value | | | | | |

# APPENDIX B

# MASS CALCULATIONS

APPENDIX B
SEDIMENT EXCAVATION CALCULATIONS
SITE 41 FEASIBILITY STUDY REPORT
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

| | Surface Area (square feet) | | | | | | | | Volume (cubic feet) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wetland | Area Per Block | No. of Blocks for Area 1 | Area 1 | No. of Blocks for Area 2 | Area 2 | No. of Blocks for Area 3 | Area 3 | No. of Blocks for Total Area | Total Area | Volume Per Block | No. of Blocks for Volume 1 | Volume 1 | No. of Blocks for Volume 2 | Volume 2 | No. of Blocks for Volume 3 | Volume 3 | No. of Blocks for Total Area | Total Volume |
| 5A | 625 | 9 | 5625 | 69 | 43125 | 0 | 0 | 78 | 48750 | 625 | 9 | 5625 | 69 | 43125 | 0 | 0 | 78 | 48750 |
| 15 | 625 | 80 | 50000 | 0 | 0 | 0 | 0 | 80 | 50000 | 625 | 80 | 50000 | 0 | 0 | 0 | 0 | 80 | 50000 |
| 16 | 625 | 23 | 14375 | 0 | 0 | 0 | 0 | 23 | 14375 | 625 | 23 | 14375 | 0 | 0 | 0 | 0 | 23 | 14375 |
| 18A | 625 | 4 | 2500 | 4 | 2500 | 0 | 0 | 8 | 5000 | 625 | 4 | 2500 | 4 | 2500 | 0 | 0 | 8 | 5000 |
| 18B | 625 | 9 | 5625 | 0 | 0 | 0 | 0 | 9 | 5625 | 625 | 9 | 5625 | 0 | 0 | 0 | 0 | 9 | 5625 |
| 48 | 625 | 318 | 198750 | 0 | 0 | 0 | 0 | 318 | 198750 | 625 | 318 | 198750 | 0 | 0 | 0 | 0 | 318 | 198750 |
| 64 | 10000 | 92 | 920000 | 0 | 0 | 0 | 0 | 92 | 920000 | 10000 | 92 | 920000 | 0 | 0 | 0 | 0 | 92 | 920000 |

| | Surface Area (square yards) | | | | | | | | Volume (cubic yards) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wetland | Area Per Block | No. of Blocks for Area 1 | Area 1 | No. of Blocks for Area 2 | Area 2 | No. of Blocks for Area 3 | Area 3 | No. of Blocks for Total Area | Total Area | Volume Per Block | No. of Blocks for Volume 1 | Volume 1 | No. of Blocks for Volume 2 | Volume 2 | No. of Blocks for Volume 3 | Volume 3 | No. of Blocks for Total Area | Total Volume |
| 5A | 69 | 9 | 625 | 69 | 4792 | 0 | 0 | 78 | 5417 | 23 | 9 | 208 | 69 | 1597 | 0 | 0 | 78 | 1806 |
| 15 | 69 | 80 | 5556 | 0 | 0 | 0 | 0 | 80 | 5556 | 23 | 80 | 1852 | 0 | 0 | 0 | 0 | 80 | 1852 |
| 16 | 69 | 23 | 1597 | 0 | 0 | 0 | 0 | 23 | 1597 | 23 | 23 | 532 | 0 | 0 | 0 | 0 | 23 | 532 |
| 18A | 69 | 4 | 278 | 4 | 278 | 0 | 0 | 8 | 556 | 23 | 4 | 93 | 4 | 93 | 0 | 0 | 8 | 185 |
| 18B | 69 | 9 | 625 | 0 | 0 | 0 | 0 | 9 | 625 | 23 | 9 | 208 | 0 | 0 | 0 | 0 | 9 | 208 |
| 48 | 69 | 318 | 22083 | 0 | 0 | 0 | 0 | 318 | 22083 | 23 | 318 | 7361 | 0 | 0 | 0 | 0 | 318 | 7361 |
| 64 | 1111 | 92 | 102222 | 0 | 0 | 0 | 0 | 92 | 102222 | 370 | 92 | 34074 | 0 | 0 | 0 | 0 | 92 | 34074 |

Notes:
Area Per Block = length x width
Area = Area Per Black x No. of Blocks in Area
Total Area = Area 1 + Area 2 + Area 3
Volume Per Block = length x width x depth
Volume = Volume Per Block x No. of Blocks in Area
Total Volume = Volume 1 + Volume 2 + Volume 3

# APPENDIX C

# COST ANALYSES

## Wetland 3

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:33 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 22 | ea | | $66.50 | $120.00 | | $0 | $1,463 | $2,640 | $0 | $4,103 |
| **Subtotal** | | | | | | | $0 | $1,463 | $13,140 | $0 | $14,603 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,942 | | $3,942 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,314 | | $1,314 |
| G & A on Material Cost @ 10% | | | | | | | | $146 | | | $146 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $88 | | $0 | $88 |
| **Total Direct Cost** | | | | | | | $0 | $1,697 | $18,396 | $0 | $20,093 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,009 |
| **Subtotal** | | | | | | | | | | | $22,102 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $22,102 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $5,526 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$27,628** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 2**
**Annual Cost**

7/31/2009 12:33 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 2**
**Present Worth Analysis**

7/31/2009 12:33 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $27,628 | | $27,628 | 1.000 | $27,628 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$77,463** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:33 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 22 | ea | | $66.50 | $120.00 | | $0 | $1,463 | $2,640 | $0 | $4,103 |
| **Subtotal** | | | | | | | $0 | $1,463 | $13,140 | $0 | $14,603 |
| *Overhead on Labor Cost @ 30%* | | | | | | | | | $3,942 | | $3,942 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,314 | | $1,314 |
| G & A on Material Cost @ 10% | | | | | | | | $146 | | | $146 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $88 | | $0 | $88 |
| **Total Direct Cost** | | | | | | | $0 | $1,697 | $18,396 | $0 | $20,093 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,009 |
| ***Subtotal*** | | | | | | | | | | | $22,102 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $22,102 |
| *Contingency on Total Field Costs @ 25%* | | | | | | | | | | | $5,526 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$27,628** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 3**
**Annual Cost**

7/31/2009 12:33 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $3,925 | | Labor and supplies to collect samples with a crew of two. |
| Analysis/Sediment | $1,288 | | Analyze sediment samples from 4 locations for VOCs, metals, and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $8,169 | $4,000 | |
| Contingency @ 10% | $817 | $400 | |
| **TOTAL** | **$8,986** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 3**
**Alternative Sediment 3**
**Present Worth Analysis**



| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $27,628 | | $27,628 | 1.000 | $27,628 |
| 1 | | $8,986 | $8,986 | 0.935 | $8,402 |
| 2 | | $8,986 | $8,986 | 0.873 | $7,845 |
| 3 | | $8,986 | $8,986 | 0.816 | $7,332 |
| 4 | | $8,986 | $8,986 | 0.763 | $6,856 |
| 5 | | $13,386 | $13,386 | 0.713 | $9,544 |
| 6 | | $8,986 | $8,986 | 0.666 | $5,985 |
| 7 | | $8,986 | $8,986 | 0.623 | $5,598 |
| 8 | | $8,986 | $8,986 | 0.582 | $5,230 |
| 9 | | $8,986 | $8,986 | 0.544 | $4,888 |
| 10 | | $13,386 | $13,386 | 0.508 | $6,800 |
| 11 | | $8,986 | $8,986 | 0.475 | $4,268 |
| 12 | | $8,986 | $8,986 | 0.444 | $3,990 |
| 13 | | $8,986 | $8,986 | 0.415 | $3,729 |
| 14 | | $8,986 | $8,986 | 0.388 | $3,487 |
| 15 | | $13,386 | $13,386 | 0.362 | $4,846 |
| 16 | | $8,986 | $8,986 | 0.339 | $3,046 |
| 17 | | $8,986 | $8,986 | 0.317 | $2,849 |
| 18 | | $8,986 | $8,986 | 0.296 | $2,660 |
| 19 | | $8,986 | $8,986 | 0.277 | $2,489 |
| 20 | | $13,386 | $13,386 | 0.258 | $3,454 |
| 21 | | $8,986 | $8,986 | 0.242 | $2,175 |
| 22 | | $8,986 | $8,986 | 0.226 | $2,031 |
| 23 | | $8,986 | $8,986 | 0.211 | $1,896 |
| 24 | | $8,986 | $8,986 | 0.197 | $1,770 |
| 25 | | $13,386 | $13,386 | 0.184 | $2,463 |
| 26 | | $8,986 | $8,986 | 0.172 | $1,546 |
| 27 | | $8,986 | $8,986 | 0.161 | $1,447 |
| 28 | | $8,986 | $8,986 | 0.150 | $1,348 |
| 29 | | $8,986 | $8,986 | 0.141 | $1,267 |
| 30 | | $13,386 | $13,386 | 0.131 | $1,754 |
| | | | | **TOTAL PRESENT WORTH** | **$148,620** |

## Wetland 5A

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 2**
**Capital Cost**



| | Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 | Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 | Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 | **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 | Warning Signs | 14 | ea | | $66.50 | $120.00 | | $0 | $931 | $1,680 | $0 | $2,611 |
| | **Subtotal** | | | | | | | $0 | $931 | $12,180 | $0 | $13,111 |
| | Overhead on Labor Cost @ 30% | | | | | | | | | $3,654 | | $3,654 |
| | G & A on Labor Cost @ 10% | | | | | | | | | $1,218 | | $1,218 |
| | G & A on Material Cost @ 10% | | | | | | | | $93 | | | $93 |
| | G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| | G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| | Tax on Materials and Equipment Cost @ 6% | | | | | | | | $56 | | $0 | $56 |
| | **Total Direct Cost** | | | | | | | $0 | $1,080 | $17,052 | $0 | $18,132 |
| | Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| | Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,813 |
| | **Subtotal** | | | | | | | | | | | $19,945 |
| | Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| | **Total Field Cost** | | | | | | | | | | | $19,945 |
| | Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,986 |
| | Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| | **TOTAL CAPITAL COST** | | | | | | | | | | | **$24,931** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 2**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $24,931 | | $24,931 | 1.000 | $24,931 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$74,767** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 3**
**Capital Cost**

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 14 | ea | | $66.50 | $120.00 | | $0 | $931 | $1,680 | $0 | $2,611 |
| **Subtotal** | | | | | | | $0 | $931 | $12,180 | $0 | $13,111 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,654 | | $3,654 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,218 | | $1,218 |
| G & A on Material Cost @ 10% | | | | | | | | $93 | | | $93 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $56 | | $0 | $56 |
| **Total Direct Cost** | | | | | | | $0 | $1,080 | $17,052 | $0 | $18,132 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,813 |
| **Subtotal** | | | | | | | | | | | $19,945 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $19,945 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,986 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$24,931** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 3**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $3,925 | | Labor and supplies to collect samples with a crew of two. |
| Analysis/Sediment | $728 | | Analyze sediment samples from 4 locations for metals, and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $7,609 | $4,000 | |
| Contingency @ 10% | $761 | $400 | |
| **TOTAL** | **$8,370** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 5A**
**Alternative Sediment 3**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $24,931 | | $24,931 | 1.000 | $24,931 |
| 1 | | $8,370 | $8,370 | 0.935 | $7,826 |
| 2 | | $8,370 | $8,370 | 0.873 | $7,307 |
| 3 | | $8,370 | $8,370 | 0.816 | $6,830 |
| 4 | | $8,370 | $8,370 | 0.763 | $6,386 |
| 5 | | $12,770 | $12,770 | 0.713 | $9,105 |
| 6 | | $8,370 | $8,370 | 0.666 | $5,574 |
| 7 | | $8,370 | $8,370 | 0.623 | $5,214 |
| 8 | | $8,370 | $8,370 | 0.582 | $4,871 |
| 9 | | $8,370 | $8,370 | 0.544 | $4,553 |
| 10 | | $12,770 | $12,770 | 0.508 | $6,487 |
| 11 | | $8,370 | $8,370 | 0.475 | $3,976 |
| 12 | | $8,370 | $8,370 | 0.444 | $3,716 |
| 13 | | $8,370 | $8,370 | 0.415 | $3,474 |
| 14 | | $8,370 | $8,370 | 0.388 | $3,248 |
| 15 | | $12,770 | $12,770 | 0.362 | $4,623 |
| 16 | | $8,370 | $8,370 | 0.339 | $2,837 |
| 17 | | $8,370 | $8,370 | 0.317 | $2,653 |
| 18 | | $8,370 | $8,370 | 0.296 | $2,477 |
| 19 | | $8,370 | $8,370 | 0.277 | $2,318 |
| 20 | | $12,770 | $12,770 | 0.258 | $3,295 |
| 21 | | $8,370 | $8,370 | 0.242 | $2,026 |
| 22 | | $8,370 | $8,370 | 0.226 | $1,892 |
| 23 | | $8,370 | $8,370 | 0.211 | $1,766 |
| 24 | | $8,370 | $8,370 | 0.197 | $1,649 |
| 25 | | $12,770 | $12,770 | 0.184 | $2,350 |
| 26 | | $8,370 | $8,370 | 0.172 | $1,440 |
| 27 | | $8,370 | $8,370 | 0.161 | $1,348 |
| 28 | | $8,370 | $8,370 | 0.150 | $1,255 |
| 29 | | $8,370 | $8,370 | 0.141 | $1,180 |
| 30 | | $12,770 | $12,770 | 0.131 | $1,673 |
| | | | | **TOTAL PRESENT WORTH** | **$138,280** |

NAS PENSACOLA
Pensacola, Florida
Wetland 5A
Alternative Sediment 4
Capital Cost

7/31/2009 12:35 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 7 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,141 | $2,898 | $4,039 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 3 | mo | | $210.00 | $350.00 | | $0 | $630 | $1,050 | $0 | $1,680 |
| 3.2 Construction Survey Support | 5 | day | $1,025.00 | | | | $5,125 | $0 | $0 | $0 | $5,125 |
| 3.3 Site Superintendent | 10 | week | | | $1,234.20 | | $0 | $0 | $12,342 | $0 | $12,342 |
| 3.4 Site Health & Safety and QA/QC | 10 | week | | | $701.20 | | $0 | $0 | $7,012 | $0 | $7,012 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 2 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $2,284 | $4,204 | $2,906 | $9,394 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 2,000 | gal | | $0.20 | | | $0 | $400 | $0 | $0 | $400 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 2 | mo | | | | $730.00 | $0 | $0 | $0 | $1,460 | $1,460 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 2 | mo | | | | $656.00 | $0 | $0 | $0 | $1,312 | $1,312 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 2 | mo | $950.00 | | | | $1,900 | $0 | $0 | $0 | $1,900 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 10 | day | | | $318.80 | $532.40 | $0 | $0 | $3,188 | $5,324 | $8,512 |
| 5.2 Brush Chipper | 10 | day | | | | $298.20 | $0 | $0 | $0 | $2,982 | $2,982 |
| 5.3 Site Labor, (3 laborers) | 10 | day | | | $726.00 | | $0 | $0 | $7,260 | $0 | $7,260 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 15 | day | | | $327.60 | $1,200.00 | $0 | $0 | $4,914 | $18,000 | $22,914 |
| 6.2 Dozer, 105 hp | 15 | day | | | $318.80 | $532.40 | $0 | $0 | $4,782 | $7,986 | $12,768 |
| 6.3 Off-road Truck, 25 cy, 2 each | 30 | day | | | $244.80 | $1,060.00 | $0 | $0 | $7,344 | $31,800 | $39,144 |
| 6.4 Swamp Mats, 11,000 sf | 3 | week | | | | $2,630.00 | $0 | $0 | $0 | $7,890 | $7,890 |
| 6.5 Wheeled Front-end Loader | 15 | day | | | $318.80 | $826.80 | 0 | $0 | $4,782 | $12,402 | $17,184 |
| 6.6 Dewatering Pumps, 2 each | 15 | day | | | | $345.80 | $0 | $0 | $0 | $5,187 | $5,187 |
| 6.7 Site Labor, (3 laborers) | 15 | day | | | $726.00 | | $0 | $0 | $10,890 | $0 | $10,890 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 2,438 | ton | $75.00 | | | | $182,850 | $0 | $0 | $0 | $182,850 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 3 | ea | $1,000.00 | $20.00 | | | $3,000 | $60 | $0 | $0 | $3,060 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 25 | day | | | $327.60 | $1,200.00 | $0 | $0 | $8,190 | $30,000 | $38,190 |
| 7.2 Dozer, 105 hp | 25 | day | | | $318.80 | $532.40 | $0 | $0 | $7,970 | $13,310 | $21,280 |
| 7.3 Swamp Mats, 11,000 sf | 5 | week | | | | $2,630.00 | $0 | $0 | $0 | $13,150 | $13,150 |
| 7.4 Site Labor, (3 laborers) | 25 | day | | | $726.00 | | $0 | $0 | $18,150 | $0 | $18,150 |
| 7.5 Select Fill | 1,805 | cy | | $12.00 | | | $0 | $21,660 | $0 | $0 | $21,660 |
| 7.6 Wetlands Restoration | 1.1 | ac | $30,000.00 | | | | $33,000 | $0 | $0 | $0 | $33,000 |
| 7.7 Grade & Seed Cover | 5,417 | sy | | $0.42 | $1.53 | $0.29 | $0 | $2,275 | $8,288 | $1,571 | $12,134 |
| **Subtotal** | | | | | | | $225,875 | $46,309 | $129,157 | $164,103 | $565,444 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $38,747 | | $38,747 |
| G & A on Labor Cost @ 10% | | | | | | | | | $12,916 | | $12,916 |
| G & A on Material Cost @ 10% | | | | | | | | $4,631 | | | $4,631 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $16,410 | $16,410 |
| G & A on Subcontract Cost @ 10% | | | | | | | $22,588 | | | | $22,588 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $2,779 | | $9,846 | $12,625 |
| **Total Direct Cost** | | | | | | | $248,463 | $53,719 | $180,820 | $190,359 | $673,360 |

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Cost @ 30% | (excluding transportation and disposal cost) | | | | | | | | | | $146,583 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $67,336 |
| **Subtotal** | | | | | | | | | | | $887,279 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $17,746 |
| Delineation Sampling | | | | | | | | | | | $35,704 |
| **Total Field Cost** | | | | | | | | | | | $940,729 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $188,146 |
| Engineering on Total Field Cost @ 5% | | | | | | | | | | | $47,036 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$1,175,911** |

## Wetland 15

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:35 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 8 | ea | | $66.50 | $120.00 | | $0 | $532 | $960 | $0 | $1,492 |
| **Subtotal** | | | | | | | $0 | $532 | $11,460 | $0 | $11,992 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,438 | | $3,438 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,146 | | $1,146 |
| G & A on Material Cost @ 10% | | | | | | | | $53 | | | $53 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $32 | | $0 | $32 |
| **Total Direct Cost** | | | | | | | $0 | $617 | $16,044 | $0 | $16,661 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,666 |
| **Subtotal** | | | | | | | | | | | $18,327 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $18,327 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,582 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$22,909** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 2**
**Annual Cost**

7/31/2009 12:35 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $22,909 | | $22,909 | 1.000 | $22,909 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$72,745** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:35 PM

| | Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 | Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 | Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 | **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 | Warning Signs | 8 | ea | | $66.50 | $120.00 | | $0 | $532 | $960 | $0 | $1,492 |
| | **Subtotal** | | | | | | | $0 | $532 | $11,460 | $0 | $11,992 |
| | Overhead on Labor Cost @ 30% | | | | | | | | | $3,438 | | $3,438 |
| | G & A on Labor Cost @ 10% | | | | | | | | | $1,146 | | $1,146 |
| | G & A on Material Cost @ 10% | | | | | | | | $53 | | | $53 |
| | G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| | G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| | Tax on Materials and Equipment Cost @ 6% | | | | | | | | $32 | | $0 | $32 |
| | **Total Direct Cost** | | | | | | | $0 | $617 | $16,044 | $0 | $16,661 |
| | Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| | Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,666 |
| | **Subtotal** | | | | | | | | | | | $18,327 |
| | Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| | **Total Field Cost** | | | | | | | | | | | $18,327 |
| | Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,582 |
| | Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| | **TOTAL CAPITAL COST** | | | | | | | | | | | **$22,909** |

NAS PENSACOLA
Pensacola, Florida
Wetland 15
Alternative Sediment 3
Annual Cost

7/31/2009 12:35 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $3,925 | | Labor and supplies to collect samples with a crew of two. |
| Analysis/Sediment | $2,968 | | Analyze sediment samples from 4 locations for PCBs, SVOCs, metals, and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $9,849 | $4,000 | |
| Contingency @ 10% | $985 | $400 | |
| **TOTAL** | **$10,834** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 3**
**Present Worth Analysis**

7/31/2009 12:35 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $22,909 | | $22,909 | 1.000 | $22,909 |
| 1 | | $10,834 | $10,834 | 0.935 | $10,130 |
| 2 | | $10,834 | $10,834 | 0.873 | $9,458 |
| 3 | | $10,834 | $10,834 | 0.816 | $8,840 |
| 4 | | $10,834 | $10,834 | 0.763 | $8,266 |
| 5 | | $15,234 | $15,234 | 0.713 | $10,862 |
| 6 | | $10,834 | $10,834 | 0.666 | $7,215 |
| 7 | | $10,834 | $10,834 | 0.623 | $6,750 |
| 8 | | $10,834 | $10,834 | 0.582 | $6,305 |
| 9 | | $10,834 | $10,834 | 0.544 | $5,894 |
| 10 | | $15,234 | $15,234 | 0.508 | $7,739 |
| 11 | | $10,834 | $10,834 | 0.475 | $5,146 |
| 12 | | $10,834 | $10,834 | 0.444 | $4,810 |
| 13 | | $10,834 | $10,834 | 0.415 | $4,496 |
| 14 | | $10,834 | $10,834 | 0.388 | $4,204 |
| 15 | | $15,234 | $15,234 | 0.362 | $5,515 |
| 16 | | $10,834 | $10,834 | 0.339 | $3,673 |
| 17 | | $10,834 | $10,834 | 0.317 | $3,434 |
| 18 | | $10,834 | $10,834 | 0.296 | $3,207 |
| 19 | | $10,834 | $10,834 | 0.277 | $3,001 |
| 20 | | $15,234 | $15,234 | 0.258 | $3,930 |
| 21 | | $10,834 | $10,834 | 0.242 | $2,622 |
| 22 | | $10,834 | $10,834 | 0.226 | $2,448 |
| 23 | | $10,834 | $10,834 | 0.211 | $2,286 |
| 24 | | $10,834 | $10,834 | 0.197 | $2,134 |
| 25 | | $15,234 | $15,234 | 0.184 | $2,803 |
| 26 | | $10,834 | $10,834 | 0.172 | $1,863 |
| 27 | | $10,834 | $10,834 | 0.161 | $1,744 |
| 28 | | $10,834 | $10,834 | 0.150 | $1,625 |
| 29 | | $10,834 | $10,834 | 0.141 | $1,528 |
| 30 | | $15,234 | $15,234 | 0.131 | $1,996 |
| | | | | **TOTAL PRESENT WORTH** | **$166,833** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 4**
**Capital Cost**



| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 7 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,141 | $2,898 | $4,039 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 2 | mo | | $210.00 | $350.00 | | $0 | $420 | $700 | $0 | $1,120 |
| 3.2 Construction Survey Support | 4 | day | $1,025.00 | | | | $4,100 | $0 | $0 | $0 | $4,100 |
| 3.3 Site Superintendent | 9 | week | | | $1,234.20 | | $0 | $0 | $11,108 | $0 | $11,108 |
| 3.4 Site Health & Safety and QA/QC | 9 | week | | | $701.20 | | $0 | $0 | $6,311 | $0 | $6,311 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 1 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $1,142 | $2,102 | $1,453 | $4,697 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 1,000 | gal | | $0.20 | | | $0 | $200 | $0 | $0 | $200 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 1 | mo | | | | $730.00 | $0 | $0 | $0 | $730 | $730 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 1 | mo | | | | $656.00 | $0 | $0 | $0 | $656 | $656 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 1 | mo | $950.00 | | | | $950 | $0 | $0 | $0 | $950 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 10 | day | | | $318.80 | $532.40 | $0 | $0 | $3,188 | $5,324 | $8,512 |
| 5.2 Brush Chipper | 10 | day | | | | $298.20 | $0 | $0 | $0 | $2,982 | $2,982 |
| 5.3 Site Labor, (3 laborers) | 10 | day | | | $726.00 | | $0 | $0 | $7,260 | $0 | $7,260 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 13 | day | | | $327.60 | $1,200.00 | $0 | $0 | $4,259 | $15,600 | $19,859 |
| 6.2 Dozer, 105 hp | 13 | day | | | $318.80 | $532.40 | $0 | $0 | $4,144 | $6,921 | $11,066 |
| 6.3 Off-road Truck, 25 cy, 2 each | 26 | day | | | $244.80 | $1,060.00 | $0 | $0 | $6,365 | $27,560 | $33,925 |
| 6.4 Swamp Mats, 11,000 sf | 3 | week | | | | $2,630.00 | $0 | $0 | $0 | $7,890 | $7,890 |
| 6.5 Wheeled Front-end Loader | 13 | day | | | $318.80 | $826.80 | 0 | $0 | $4,144 | $10,748 | $14,893 |
| 6.6 Dewatering Pumps, 2 each | 13 | day | | | | $345.80 | $0 | $0 | $0 | $4,495 | $4,495 |
| 6.7 Site Labor, (3 laborers) | 13 | day | | | $726.00 | | $0 | $0 | $9,438 | $0 | $9,438 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 2,500 | ton | $75.00 | | | | $187,500 | $0 | $0 | $0 | $187,500 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 3 | ea | $1,000.00 | $20.00 | | | $3,000 | $60 | $0 | $0 | $3,060 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 22 | day | | | $327.60 | $1,200.00 | $0 | $0 | $7,207 | $26,400 | $33,607 |
| 7.2 Dozer, 105 hp | 22 | day | | | $318.80 | $532.40 | $0 | $0 | $7,014 | $11,713 | $18,726 |
| 7.3 Site Labor, (3 laborers) | 22 | day | | | $726.00 | | $0 | $0 | $15,972 | $0 | $15,972 |
| 7.4 Swamp Mats, 11,000 sf | 4 | week | | | | $2,630.00 | $0 | $0 | $0 | $10,520 | $10,520 |
| 7.5 Select Fill | 1,852 | cy | | $12.00 | | | $0 | $22,224 | $0 | $0 | $22,224 |
| 7.6 Wetlands Restoration | 1.1 | ac | $30,000.00 | | | | $33,000 | $0 | $0 | $0 | $33,000 |
| 7.7 Grade & Seed Cover | 5,556 | sy | | $0.42 | $1.53 | $0.29 | $0 | $2,334 | $8,501 | $1,611 | $12,445 |
| **Subtotal** | | | | | | | $228,550 | $45,380 | $116,503 | $143,427 | $533,860 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $34,951 | | $34,951 |
| G & A on Labor Cost @ 10% | | | | | | | | | $11,650 | | $11,650 |
| G & A on Material Cost @ 10% | | | | | | | | $4,538 | | | $4,538 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $14,343 | $14,343 |
| G & A on Subcontract Cost @ 10% | | | | | | | $22,855 | | | | $22,855 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $2,723 | | $8,606 | $11,328 |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 15**
**Alternative Sediment 4**
**Capital Cost**



| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Direct Cost** | | | | | | | $251,405 | $52,640 | $163,105 | $166,375 | $633,525 |
| Indirects on Total Direct Cost @ 30% | | (excluding transportation and disposal cost) | | | | | | | | | $133,523 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $63,353 |
| **Subtotal** | | | | | | | | | | | $830,401 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $16,608 |
| Delineation Sampling | | | | | | | | | | | $79,256 |
| **Total Field Cost** | | | | | | | | | | | $926,265 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $185,253 |
| Engineering on Total Field Cost @ 6% | | | | | | | | | | | $55,576 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$1,167,094** |

**Wetland 16**

NAS PENSACOLA
Pensacola, Florida
Wetland 16
Alternative Sediment 2
Capital Cost

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 7 | ea | | $66.50 | $120.00 | | $0 | $466 | $840 | $0 | $1,306 |
| **Subtotal** | | | | | | | $0 | $466 | $11,340 | $0 | $11,806 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,402 | | $3,402 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,134 | | $1,134 |
| G & A on Material Cost @ 10% | | | | | | | | $47 | | | $47 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $28 | | $0 | $28 |
| **Total Direct Cost** | | | | | | | $0 | $540 | $15,876 | $0 | $16,416 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,642 |
| **Subtotal** | | | | | | | | | | | $18,058 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $18,058 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,514 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$22,572** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 2**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $22,572 | | $22,572 | 1.000 | $22,572 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$72,407** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 7 | ea | | $66.50 | $120.00 | | $0 | $466 | $840 | $0 | $1,306 |
| **Subtotal** | | | | | | | $0 | $466 | $11,340 | $0 | $11,806 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,402 | | $3,402 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,134 | | $1,134 |
| G & A on Material Cost @ 10% | | | | | | | | $47 | | | $47 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $28 | | $0 | $28 |
| **Total Direct Cost** | | | | | | | $0 | $540 | $15,876 | $0 | $16,416 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,642 |
| **Subtotal** | | | | | | | | | | | $18,058 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $18,058 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,514 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$22,572** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 3**
**Annual Cost**

7/31/2009 12:34 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $6,325 | | Labor and supplies to collect samples using boat and a crew of two. |
| Analysis/Sediment | $1,148 | | Analyze sediment samples from 4 locations for PCBs, and metals. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $10,429 | $4,000 | |
| Contingency @ 10% | $1,043 | $400 | |
| **TOTAL** | **$11,472** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 3**
**Present Worth Analysis**

7/31/2009 12:34 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $22,572 | | $22,572 | 1.000 | $22,572 |
| 1 | | $11,472 | $11,472 | 0.935 | $10,726 |
| 2 | | $11,472 | $11,472 | 0.873 | $10,015 |
| 3 | | $11,472 | $11,472 | 0.816 | $9,361 |
| 4 | | $11,472 | $11,472 | 0.763 | $8,753 |
| 5 | | $15,872 | $15,872 | 0.713 | $11,317 |
| 6 | | $11,472 | $11,472 | 0.666 | $7,640 |
| 7 | | $11,472 | $11,472 | 0.623 | $7,147 |
| 8 | | $11,472 | $11,472 | 0.582 | $6,677 |
| 9 | | $11,472 | $11,472 | 0.544 | $6,241 |
| 10 | | $15,872 | $15,872 | 0.508 | $8,063 |
| 11 | | $11,472 | $11,472 | 0.475 | $5,449 |
| 12 | | $11,472 | $11,472 | 0.444 | $5,094 |
| 13 | | $11,472 | $11,472 | 0.415 | $4,761 |
| 14 | | $11,472 | $11,472 | 0.388 | $4,451 |
| 15 | | $15,872 | $15,872 | 0.362 | $5,746 |
| 16 | | $11,472 | $11,472 | 0.339 | $3,889 |
| 17 | | $11,472 | $11,472 | 0.317 | $3,637 |
| 18 | | $11,472 | $11,472 | 0.296 | $3,396 |
| 19 | | $11,472 | $11,472 | 0.277 | $3,178 |
| 20 | | $15,872 | $15,872 | 0.258 | $4,095 |
| 21 | | $11,472 | $11,472 | 0.242 | $2,776 |
| 22 | | $11,472 | $11,472 | 0.226 | $2,593 |
| 23 | | $11,472 | $11,472 | 0.211 | $2,421 |
| 24 | | $11,472 | $11,472 | 0.197 | $2,260 |
| 25 | | $15,872 | $15,872 | 0.184 | $2,920 |
| 26 | | $11,472 | $11,472 | 0.172 | $1,973 |
| 27 | | $11,472 | $11,472 | 0.161 | $1,847 |
| 28 | | $11,472 | $11,472 | 0.150 | $1,721 |
| 29 | | $11,472 | $11,472 | 0.141 | $1,618 |
| 30 | | $15,872 | $15,872 | 0.131 | $2,079 |
| | | | | **TOTAL PRESENT WORTH** | **$174,413** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 16**
**Alternative Sediment 4**
**Capital Cost**

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 7 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,141 | $2,898 | $4,039 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 1 | mo | | $210.00 | $350.00 | | $0 | $210 | $350 | $0 | $560 |
| 3.2 Construction Survey Support | 3 | day | $1,025.00 | | | | $3,075 | $0 | $0 | $0 | $3,075 |
| 3.3 Site Superintendent | 5 | week | | | $1,234.20 | | $0 | $0 | $6,171 | $0 | $6,171 |
| 3.4 Site Health & Safety and QA/QC | 5 | week | | | $701.20 | | $0 | $0 | $3,506 | $0 | $3,506 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 1 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $1,142 | $2,102 | $1,453 | $4,697 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 1,000 | gal | | $0.20 | | | $0 | $200 | $0 | $0 | $200 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 1 | mo | | | | $730.00 | $0 | $0 | $0 | $730 | $730 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 1 | mo | | | | $656.00 | $0 | $0 | $0 | $656 | $656 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 1 | mo | $950.00 | | | | $950 | $0 | $0 | $0 | $950 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 7 | day | | | $318.80 | $532.40 | $0 | $0 | $2,232 | $3,727 | $5,958 |
| 5.2 Brush Chipper | 7 | day | | | | $298.20 | $0 | $0 | $0 | $2,087 | $2,087 |
| 5.3 Site Labor, (3 laborers) | 7 | day | | | $726.00 | | $0 | $0 | $5,082 | $0 | $5,082 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 8 | day | | | $327.60 | $1,200.00 | $0 | $0 | $2,621 | $9,600 | $12,221 |
| 6.2 Dozer, 105 hp | 8 | day | | | $318.80 | $532.40 | $0 | $0 | $2,550 | $4,259 | $6,810 |
| 6.3 Off-road Truck, 25 cy, 2 each | 16 | day | | | $244.80 | $1,060.00 | $0 | $0 | $3,917 | $16,960 | $20,877 |
| 6.4 Swamp Mats, 11,000 sf | 2 | week | | | | $2,630.00 | $0 | $0 | $0 | $5,260 | $5,260 |
| 6.5 Wheeled Front-end Loader | 8 | day | | | $318.80 | $826.80 | 0 | $0 | $2,550 | $6,614 | $9,165 |
| 6.6 Dewatering Pumps, 2 each | 8 | day | | | | $345.80 | $0 | $0 | $0 | $2,766 | $2,766 |
| 6.7 Site Labor, (3 laborers) | 8 | day | | | $726.00 | | $0 | $0 | $5,808 | $0 | $5,808 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 719 | ton | $75.00 | | | | $53,925 | $0 | $0 | $0 | $53,925 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 1 | ea | $1,000.00 | $20.00 | | | $1,000 | $20 | $0 | $0 | $1,020 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 10 | day | | | $327.60 | $1,200.00 | $0 | $0 | $3,276 | $12,000 | $15,276 |
| 7.2 Dozer, 105 hp | 10 | day | | | $318.80 | $532.40 | $0 | $0 | $3,188 | $5,324 | $8,512 |
| 7.3 Swamp Mats, 11,000 sf | 2 | week | | | | $2,630.00 | $0 | $0 | $0 | $5,260 | $5,260 |
| 7.4 Site Labor, (3 laborers) | 10 | day | | | $726.00 | | $0 | $0 | $7,260 | $0 | $7,260 |
| 7.5 Select Fill | 532 | cy | | $12.00 | | | $0 | $6,384 | $0 | $0 | $6,384 |
| 7.6 Wetlands Restoration | 0.3 | ac | $30,000.00 | | | | $9,000 | $0 | $0 | $0 | $9,000 |
| 7.7 Grade & Seed Cover | 1,597 | sy | | $0.42 | $1.53 | $0.29 | $0 | $671 | $2,443 | $463 | $3,577 |
| **Subtotal** | | | | | | | $67,950 | $27,627 | $71,847 | $85,983 | $253,407 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $21,554 | | $21,554 |
| G & A on Labor Cost @ 10% | | | | | | | | | $7,185 | | $7,185 |
| G & A on Material Cost @ 10% | | | | | | | | $2,763 | | | $2,763 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $8,598 | $8,598 |
| G & A on Subcontract Cost @ 10% | | | | | | | $6,795 | | | | $6,795 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $1,658 | | $5,159 | $6,817 |
| **Total Direct Cost** | | | | | | | $74,745 | $32,047 | $100,586 | $99,741 | $307,119 |

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Cost @ 30% | | (excluding transportation and disposal cost) | | | | | | | | | $75,673 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $30,712 |
| **Subtotal** | | | | | | | | | | | $413,504 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $8,270 |
| Delineation Sampling | | | | | | | | | | | $22,899 |
| **Total Field Cost** | | | | | | | | | | | $444,673 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $88,935 |
| Engineering on Total Field Cost @ 8% | | | | | | | | | | | $35,574 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$569,182** |

# Wetland 18A

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:34 PM

| | Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 | Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 | Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 | **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 | Warning Signs | 10 | ea | | $66.50 | $120.00 | | $0 | $665 | $1,200 | $0 | $1,865 |
| | **Subtotal** | | | | | | | $0 | $665 | $11,700 | $0 | $12,365 |
| | Overhead on Labor Cost @ 30% | | | | | | | | | $3,510 | | $3,510 |
| | G & A on Labor Cost @ 10% | | | | | | | | | $1,170 | | $1,170 |
| | G & A on Material Cost @ 10% | | | | | | | | $67 | | | $67 |
| | G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| | G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| | Tax on Materials and Equipment Cost @ 6% | | | | | | | | $40 | | $0 | $40 |
| | **Total Direct Cost** | | | | | | | $0 | $771 | $16,380 | $0 | $17,151 |
| | Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| | Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,715 |
| | **Subtotal** | | | | | | | | | | | $18,867 |
| | Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| | **Total Field Cost** | | | | | | | | | | | $18,867 |
| | Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,717 |
| | Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| | **TOTAL CAPITAL COST** | | | | | | | | | | | **$23,583** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 2**
**Annual Cost**

7/31/2009 12:34 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $23,583 | | $23,583 | 1.000 | $23,583 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$73,419** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 10 | ea | | $66.50 | $120.00 | | $0 | $665 | $1,200 | $0 | $1,865 |
| **Subtotal** | | | | | | | $0 | $665 | $11,700 | $0 | $12,365 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,510 | | $3,510 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,170 | | $1,170 |
| G & A on Material Cost @ 10% | | | | | | | | $67 | | | $67 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $40 | | $0 | $40 |
| **Total Direct Cost** | | | | | | | $0 | $771 | $16,380 | $0 | $17,151 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,715 |
| **Subtotal** | | | | | | | | | | | $18,867 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $18,867 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,717 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$23,583** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 3**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $3,925 | | Labor and supplies to collect samples with a crew of two. |
| Analysis/Sediment | $3,276 | | Analyze sediment samples from 4 locations for metals, pesticides, and SVOCs. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $10,157 | $4,000 | |
| Contingency @ 10% | $1,016 | $400 | |
| **TOTAL** | **$11,173** | **$4,400** | |

NAS PENSACOLA
Pensacola, Florida
Wetland 18A
Alternative Sediment 3
Present Worth Analysis



| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $23,583 | | $23,583 | 1.000 | $23,583 |
| 1 | | $11,173 | $11,173 | 0.935 | $10,446 |
| 2 | | $11,173 | $11,173 | 0.873 | $9,754 |
| 3 | | $11,173 | $11,173 | 0.816 | $9,117 |
| 4 | | $11,173 | $11,173 | 0.763 | $8,525 |
| 5 | | $15,573 | $15,573 | 0.713 | $11,103 |
| 6 | | $11,173 | $11,173 | 0.666 | $7,441 |
| 7 | | $11,173 | $11,173 | 0.623 | $6,961 |
| 8 | | $11,173 | $11,173 | 0.582 | $6,503 |
| 9 | | $11,173 | $11,173 | 0.544 | $6,078 |
| 10 | | $15,573 | $15,573 | 0.508 | $7,911 |
| 11 | | $11,173 | $11,173 | 0.475 | $5,307 |
| 12 | | $11,173 | $11,173 | 0.444 | $4,961 |
| 13 | | $11,173 | $11,173 | 0.415 | $4,637 |
| 14 | | $11,173 | $11,173 | 0.388 | $4,335 |
| 15 | | $15,573 | $15,573 | 0.362 | $5,637 |
| 16 | | $11,173 | $11,173 | 0.339 | $3,788 |
| 17 | | $11,173 | $11,173 | 0.317 | $3,542 |
| 18 | | $11,173 | $11,173 | 0.296 | $3,307 |
| 19 | | $11,173 | $11,173 | 0.277 | $3,095 |
| 20 | | $15,573 | $15,573 | 0.258 | $4,018 |
| 21 | | $11,173 | $11,173 | 0.242 | $2,704 |
| 22 | | $11,173 | $11,173 | 0.226 | $2,525 |
| 23 | | $11,173 | $11,173 | 0.211 | $2,357 |
| 24 | | $11,173 | $11,173 | 0.197 | $2,201 |
| 25 | | $15,573 | $15,573 | 0.184 | $2,865 |
| 26 | | $11,173 | $11,173 | 0.172 | $1,922 |
| 27 | | $11,173 | $11,173 | 0.161 | $1,799 |
| 28 | | $11,173 | $11,173 | 0.150 | $1,676 |
| 29 | | $11,173 | $11,173 | 0.141 | $1,575 |
| 30 | | $15,573 | $15,573 | 0.131 | $2,040 |
| | | | | **TOTAL PRESENT WORTH** | **$171,712** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18A**
**Alternative Sediment 4**
**Capital Cost**

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 7 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,141 | $2,898 | $4,039 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 4 | mo | | $210.00 | $350.00 | | $0 | $840 | $1,400 | $0 | $2,240 |
| 3.2 Construction Survey Support | 7 | day | $1,025.00 | | | | $7,175 | $0 | $0 | $0 | $7,175 |
| 3.3 Site Superintendent | 15 | week | | | $1,234.20 | | $0 | $0 | $18,513 | $0 | $18,513 |
| 3.4 Site Health & Safety and QA/QC | 15 | week | | | $701.20 | | $0 | $0 | $10,518 | $0 | $10,518 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 3 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $3,426 | $6,306 | $4,359 | $14,091 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 3,000 | gal | | $0.20 | | | $0 | $600 | $0 | $0 | $600 |
| 4,4 Decon Water Storage Tank, 6,000 gallon | 3 | mo | | | | $730.00 | $0 | $0 | $0 | $2,190 | $2,190 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 3 | mo | | | | $656.00 | $0 | $0 | $0 | $1,968 | $1,968 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 3 | mo | $950.00 | | | | $2,850 | $0 | $0 | $0 | $2,850 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 15 | day | | | $318.80 | $532.40 | $0 | $0 | $4,782 | $7,986 | $12,768 |
| 5.2 Brush Chipper | 15 | day | | | | $298.20 | $0 | $0 | $0 | $4,473 | $4,473 |
| 5.3 Site Labor, (3 laborers) | 15 | day | | | $726.00 | | $0 | $0 | $10,890 | $0 | $10,890 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 22 | day | | | $327.60 | $1,200.00 | $0 | $0 | $7,207 | $26,400 | $33,607 |
| 6.2 Dozer, 105 hp | 22 | day | | | $318.80 | $532.40 | $0 | $0 | $7,014 | $11,713 | $18,726 |
| 6.3 Off-road Truck, 25 cy, 2 each | 44 | day | | | $244.80 | $1,060.00 | $0 | $0 | $10,771 | $46,640 | $57,411 |
| 6.4 Swamp Mats, 11,000 sf | 4 | week | | | | $2,630.00 | $0 | $0 | $0 | $10,520 | $10,520 |
| 6.5 Wheeled Front-end Loader | 22 | day | | | $318.80 | $826.80 | 0 | $0 | $7,014 | $18,190 | $25,203 |
| 6.6 Dewatering Pumps, 2 each | 22 | day | | | | $345.80 | $0 | $0 | $0 | $7,608 | $7,608 |
| 6.7 Site Labor, (3 laborers) | 22 | day | | | $726.00 | | $0 | $0 | $15,972 | $0 | $15,972 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 250 | ton | $75.00 | | | | $18,750 | $0 | $0 | $0 | $18,750 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 5 | ea | $1,000.00 | $20.00 | | | $5,000 | $100 | $0 | $0 | $5,100 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 38 | day | | | $327.60 | $1,200.00 | $0 | $0 | $12,449 | $45,600 | $58,049 |
| 7.2 Dozer, 105 hp | 38 | day | | | $318.80 | $532.40 | $0 | $0 | $12,114 | $20,231 | $32,346 |
| 7.3 Swamp Mats, 11,000 sf | 7 | week | | | | $2,630.00 | $0 | $0 | $0 | $18,410 | $18,410 |
| 7.4 Site Labor, (3 laborers) | 38 | day | | | $726.00 | | $0 | $0 | $27,588 | $0 | $27,588 |
| 7.5 Select Fill | 185 | cy | | $12.00 | | | $0 | $2,220 | $0 | $0 | $2,220 |
| 7.6 Wetlands Restoration | 0.1 | ac | $30,000.00 | | | | $3,000 | $0 | $0 | $0 | $3,000 |
| 7.7 Grade & Seed Cover | 556 | sy | | $0.42 | $1.53 | $0.29 | $0 | $234 | $851 | $161 | $1,245 |
| **Subtotal** | | | | | | | $36,775 | $26,420 | $172,179 | $235,271 | $470,645 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $51,654 | | $51,654 |
| G & A on Labor Cost @ 10% | | | | | | | | | $17,218 | | $17,218 |
| G & A on Material Cost @ 10% | | | | | | | | $2,642 | | | $2,642 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $23,527 | $23,527 |
| G & A on Subcontract Cost @ 10% | | | | | | | $3,678 | | | | $3,678 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $1,585 | | $14,116 | $15,701 |
| **Total Direct Cost** | | | | | | | $40,453 | $30,647 | $241,051 | $272,915 | $585,065 |

NAS PENSACOLA
Pensacola, Florida
Wetland 18A
Alternative Sediment 4
Capital Cost



| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Cost @ 30% | | (excluding transportation and disposal cost) | | | | | | | | | $169,040 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $58,507 |
| **Subtotal** | | | | | | | | | | | $812,611 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $16,252 |
| Delineation Sampling | | | | | | | | | | | $32,896 |
| ***Total Field Cost*** | | | | | | | | | | | $861,760 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $172,352 |
| Engineering on Total Field Cost @ 5% | | | | | | | | | | | $43,088 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$1,077,200** |

**Wetland 18B**

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18B**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:34 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 5 | ea | | $66.50 | $120.00 | | $0 | $333 | $600 | $0 | $933 |
| **Subtotal** | | | | | | | $0 | $333 | $11,100 | $0 | $11,433 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,330 | | $3,330 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,110 | | $1,110 |
| G & A on Material Cost @ 10% | | | | | | | | $33 | | | $33 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $20 | | $0 | $20 |
| **Total Direct Cost** | | | | | | | $0 | $386 | $15,540 | $0 | $15,926 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $1,593 |
| **Subtotal** | | | | | | | | | | | $17,518 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $17,518 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $4,380 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$21,898** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18B**
**Alternative Sediment 2**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18B**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $21,898 | | $21,898 | 1.000 | $21,898 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$71,733** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18B**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:34 PM

| | Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 | Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 | Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 | **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 | Warning Signs | 5 | ea | | $66.50 | $120.00 | | $0 | $333 | $600 | $0 | $933 |
| | **Subtotal** | | | | | | | $0 | $333 | $11,100 | $0 | $11,433 |
| | Overhead on Labor Cost @ | 30% | | | | | | | | $3,330 | | $3,330 |
| | G & A on Labor Cost @ | 10% | | | | | | | | $1,110 | | $1,110 |
| | G & A on Material Cost @ | 10% | | | | | | | $33 | | | $33 |
| | G & A on Equipment Cost @ | 10% | | | | | | | | | $0 | $0 |
| | G & A on Subcontract Cost @ | 10% | | | | | | $0 | | | | $0 |
| | Tax on Materials and Equipment Cost @ | 6% | | | | | | | $20 | | $0 | $20 |
| | **Total Direct Cost** | | | | | | | $0 | $386 | $15,540 | $0 | $15,926 |
| | Indirects on Total Direct Cost @ | 0% | | | | | | | | | | $0 |
| | Profit on Total Direct Cost @ | 10% | | | | | | | | | | $1,593 |
| | **Subtotal** | | | | | | | | | | | $17,518 |
| | Health & Safety Monitoring @ | 0% | | | | | | | | | | $0 |
| | **Total Field Cost** | | | | | | | | | | | $17,518 |
| | Contingency on Total Field Costs @ | 25% | | | | | | | | | | $4,380 |
| | Engineering on Total Field Cost @ | 0% | | | | | | | | | | $0 |
| | **TOTAL CAPITAL COST** | | | | | | | | | | | **$21,898** |

NAS PENSACOLA
Pensacola, Florida
Wetland 18B
Alternative Sediment 3
Annual Cost

7/31/2009 12:34 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $6,325 | | Labor and supplies to collect samples using boat and a crew of two. |
| Analysis/Sediment | $728 | | Analyze sediment samples from 4 locations for metals and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $10,009 | $4,000 | |
| Contingency @ 10% | $1,001 | $400 | |
| **TOTAL** | **$11,010** | **$4,400** | |

NAS PENSACOLA
Pensacola, Florida
Wetland 18B
Alternative Sediment 3
Present Worth Analysis



| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $21,898 | | $21,898 | 1.000 | $21,898 |
| 1 | | $11,010 | $11,010 | 0.935 | $10,294 |
| 2 | | $11,010 | $11,010 | 0.873 | $9,612 |
| 3 | | $11,010 | $11,010 | 0.816 | $8,984 |
| 4 | | $11,010 | $11,010 | 0.763 | $8,401 |
| 5 | | $15,410 | $15,410 | 0.713 | $10,987 |
| 6 | | $11,010 | $11,010 | 0.666 | $7,333 |
| 7 | | $11,010 | $11,010 | 0.623 | $6,859 |
| 8 | | $11,010 | $11,010 | 0.582 | $6,408 |
| 9 | | $11,010 | $11,010 | 0.544 | $5,989 |
| 10 | | $15,410 | $15,410 | 0.508 | $7,828 |
| 11 | | $11,010 | $11,010 | 0.475 | $5,230 |
| 12 | | $11,010 | $11,010 | 0.444 | $4,888 |
| 13 | | $11,010 | $11,010 | 0.415 | $4,569 |
| 14 | | $11,010 | $11,010 | 0.388 | $4,272 |
| 15 | | $15,410 | $15,410 | 0.362 | $5,578 |
| 16 | | $11,010 | $11,010 | 0.339 | $3,732 |
| 17 | | $11,010 | $11,010 | 0.317 | $3,490 |
| 18 | | $11,010 | $11,010 | 0.296 | $3,259 |
| 19 | | $11,010 | $11,010 | 0.277 | $3,050 |
| 20 | | $15,410 | $15,410 | 0.258 | $3,976 |
| 21 | | $11,010 | $11,010 | 0.242 | $2,664 |
| 22 | | $11,010 | $11,010 | 0.226 | $2,488 |
| 23 | | $11,010 | $11,010 | 0.211 | $2,323 |
| 24 | | $11,010 | $11,010 | 0.197 | $2,169 |
| 25 | | $15,410 | $15,410 | 0.184 | $2,835 |
| 26 | | $11,010 | $11,010 | 0.172 | $1,894 |
| 27 | | $11,010 | $11,010 | 0.161 | $1,773 |
| 28 | | $11,010 | $11,010 | 0.150 | $1,651 |
| 29 | | $11,010 | $11,010 | 0.141 | $1,552 |
| 30 | | $15,410 | $15,410 | 0.131 | $2,019 |
| | | | | **TOTAL PRESENT WORTH** | **$168,006** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 18B**
**Alternative Sediment 4**
**Capital Cost**



| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 7 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,141 | $2,898 | $4,039 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 1 | mo | | $210.00 | $350.00 | | $0 | $210 | $350 | $0 | $560 |
| 3.2 Construction Survey Support | 2 | day | $1,025.00 | | | | $2,050 | $0 | $0 | $0 | $2,050 |
| 3.3 Site Superintendent | 4 | week | | | $1,234.20 | | $0 | $0 | $4,937 | $0 | $4,937 |
| 3.4 Site Health & Safety and QA/QC | 4 | week | | | $701.20 | | $0 | $0 | $2,805 | $0 | $2,805 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 1 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $1,142 | $2,102 | $1,453 | $4,697 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 1,000 | gal | | $0.20 | | | $0 | $200 | $0 | $0 | $200 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 1 | mo | | | | $730.00 | $0 | $0 | $0 | $730 | $730 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 1 | mo | | | | $656.00 | $0 | $0 | $0 | $656 | $656 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 1 | mo | $950.00 | | | | $950 | $0 | $0 | $0 | $950 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 7 | day | | | $318.80 | $532.40 | $0 | $0 | $2,232 | $3,727 | $5,958 |
| 5.2 Brush Chipper | 7 | day | | | | $298.20 | $0 | $0 | $0 | $2,087 | $2,087 |
| 5.3 Site Labor, (3 laborers) | 7 | day | | | $726.00 | | $0 | $0 | $5,082 | $0 | $5,082 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 6 | day | | | $327.60 | $1,200.00 | $0 | $0 | $1,966 | $7,200 | $9,166 |
| 6.2 Dozer, 105 hp | 6 | day | | | $318.80 | $532.40 | $0 | $0 | $1,913 | $3,194 | $5,107 |
| 6.3 Off-road Truck, 25 cy, 2 each | 12 | day | | | $244.80 | $1,060.00 | $0 | $0 | $2,938 | $12,720 | $15,658 |
| 6.4 Swamp Mats, 11,000 sf | 1 | week | | | | $2,630.00 | $0 | $0 | $0 | $2,630 | $2,630 |
| 6.5 Wheeled Front-end Loader | 6 | day | | | $318.80 | $826.80 | 0 | $0 | $1,913 | $4,961 | $6,874 |
| 6.6 Dewatering Pumps, 2 each | 6 | day | | | | $345.80 | $0 | $0 | $0 | $2,075 | $2,075 |
| 6.7 Site Labor, (3 laborers) | 6 | day | | | $726.00 | | $0 | $0 | $4,356 | $0 | $4,356 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 281 | ton | $75.00 | | | | $21,075 | $0 | $0 | $0 | $21,075 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 1 | ea | $1,000.00 | $20.00 | | | $1,000 | $20 | $0 | $0 | $1,020 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 8 | day | | | $327.60 | $1,200.00 | $0 | $0 | $2,621 | $9,600 | $12,221 |
| 7.2 Dozer, 105 hp | 8 | day | | | $318.80 | $532.40 | $0 | $0 | $2,550 | $4,259 | $6,810 |
| 7.3 Swamp Mats, 11,000 sf | 2 | week | | | | $2,630.00 | $0 | $0 | $0 | $5,260 | $5,260 |
| 7.4 Site Labor, (3 laborers) | 8 | day | | | $726.00 | | $0 | $0 | $5,808 | $0 | $5,808 |
| 7.5 Select Fill | 208 | cy | | $12.00 | | | $0 | $2,496 | $0 | $0 | $2,496 |
| 7.6 Wetlands Restoration | 0.1 | ac | $30,000.00 | | | | $3,000 | $0 | $0 | $0 | $3,000 |
| 7.7 Grade & Seed Cover | 625 | sy | | $0.42 | $1.53 | $0.29 | $0 | $263 | $956 | $181 | $1,400 |
| **Subtotal** | | | | | | | $28,075 | $23,331 | $61,318 | $69,557 | $182,281 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $18,396 | | $18,396 |
| G & A on Labor Cost @ 10% | | | | | | | | | $6,132 | | $6,132 |
| G & A on Material Cost @ 10% | | | | | | | | $2,333 | | | $2,333 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $6,956 | $6,956 |
| G & A on Subcontract Cost @ 10% | | | | | | | $2,808 | | | | $2,808 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $1,400 | | $4,173 | $5,573 |
| **Total Direct Cost** | | | | | | | $30,883 | $27,063 | $85,846 | $80,686 | $224,477 |

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Cost @ 30% | | (excluding transportation and disposal cost) | | | | | | | | | $60,736 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $22,448 |
| **Subtotal** | | | | | | | | | | | $307,661 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $6,153 |
| Delineation Sampling | | | | | | | | | | | $15,374 |
| **Total Field Cost** | | | | | | | | | | | $329,188 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $65,838 |
| Engineering on Total Field Cost @ 10% | | | | | | | | | | | $32,919 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$427,945** |

## Wetland 48

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:48 PM

| Item | Quantity | Unit | Unit Cost | | | | Extended Cost | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Subcontract | Material | Labor | Equipment | Subcontract | Material | Labor | Equipment | Subtotal |
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 22 | ea | | $66.50 | $120.00 | | $0 | $1,463 | $2,640 | $0 | $4,103 |
| **Subtotal** | | | | | | | $0 | $1,463 | $13,140 | $0 | $14,603 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,942 | | $3,942 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,314 | | $1,314 |
| G & A on Material Cost @ 10% | | | | | | | | $146 | | | $146 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $88 | | $0 | $88 |
| **Total Direct Cost** | | | | | | | $0 | $1,697 | $18,396 | $0 | $20,093 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,009 |
| **Subtotal** | | | | | | | | | | | $22,102 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $22,102 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $5,526 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$27,628** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 2**
**Annual Cost**



| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 2**
**Present Worth Analysis**

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $27,628 | | $27,628 | 1.000 | $27,628 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$77,463** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:33 PM

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 22 | ea | | $66.50 | $120.00 | | $0 | $1,463 | $2,640 | $0 | $4,103 |
| **Subtotal** | | | | | | | $0 | $1,463 | $13,140 | $0 | $14,603 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $3,942 | | $3,942 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,314 | | $1,314 |
| G & A on Material Cost @ 10% | | | | | | | | $146 | | | $146 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $88 | | $0 | $88 |
| **Total Direct Cost** | | | | | | | $0 | $1,697 | $18,396 | $0 | $20,093 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,009 |
| **Subtotal** | | | | | | | | | | | $22,102 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $22,102 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $5,526 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$27,628** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 3**
**Annual Cost**

7/31/2009 12:34 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $3,925 | | Labor and supplies to collect samples with a crew of two. |
| Analysis/Sediment | $560 | | Analyze sediment samples from 4 locations for PAHs and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $7,441 | $4,000 | |
| Contingency @ 10% | $744 | $400 | |
| **TOTAL** | **$8,185** | **$4,400** | |

NAS PENSACOLA
Pensacola, Florida
Wetland 48
Alternative Sediment 3
Present Worth Analysis

7/31/2009 12:34 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $27,628 | | $27,628 | 1.000 | $27,628 |
| 1 | | $8,185 | $8,185 | 0.935 | $7,653 |
| 2 | | $8,185 | $8,185 | 0.873 | $7,146 |
| 3 | | $8,185 | $8,185 | 0.816 | $6,679 |
| 4 | | $8,185 | $8,185 | 0.763 | $6,245 |
| 5 | | $12,585 | $12,585 | 0.713 | $8,973 |
| 6 | | $8,185 | $8,185 | 0.666 | $5,451 |
| 7 | | $8,185 | $8,185 | 0.623 | $5,099 |
| 8 | | $8,185 | $8,185 | 0.582 | $4,764 |
| 9 | | $8,185 | $8,185 | 0.544 | $4,453 |
| 10 | | $12,585 | $12,585 | 0.508 | $6,393 |
| 11 | | $8,185 | $8,185 | 0.475 | $3,888 |
| 12 | | $8,185 | $8,185 | 0.444 | $3,634 |
| 13 | | $8,185 | $8,185 | 0.415 | $3,397 |
| 14 | | $8,185 | $8,185 | 0.388 | $3,176 |
| 15 | | $12,585 | $12,585 | 0.362 | $4,556 |
| 16 | | $8,185 | $8,185 | 0.339 | $2,775 |
| 17 | | $8,185 | $8,185 | 0.317 | $2,595 |
| 18 | | $8,185 | $8,185 | 0.296 | $2,423 |
| 19 | | $8,185 | $8,185 | 0.277 | $2,267 |
| 20 | | $12,585 | $12,585 | 0.258 | $3,247 |
| 21 | | $8,185 | $8,185 | 0.242 | $1,981 |
| 22 | | $8,185 | $8,185 | 0.226 | $1,850 |
| 23 | | $8,185 | $8,185 | 0.211 | $1,727 |
| 24 | | $8,185 | $8,185 | 0.197 | $1,612 |
| 25 | | $12,585 | $12,585 | 0.184 | $2,316 |
| 26 | | $8,185 | $8,185 | 0.172 | $1,408 |
| 27 | | $8,185 | $8,185 | 0.161 | $1,318 |
| 28 | | $8,185 | $8,185 | 0.150 | $1,228 |
| 29 | | $8,185 | $8,185 | 0.141 | $1,154 |
| 30 | | $12,585 | $12,585 | 0.131 | $1,649 |
| | | | | **TOTAL PRESENT WORTH** | **$138,683** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 48**
**Alternative Sediment 4**
**Capital Cost**



| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 200 | hr | | | $37.00 | | $0 | $0 | $7,400 | $0 | $7,400 |
| 1.2 Contractor Completion Report | 100 | hr | | | $37.00 | | $0 | $0 | $3,700 | $0 | $3,700 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 8 | ea | | | $163.00 | $414.00 | $0 | $0 | $1,304 | $3,312 | $4,616 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 4 | mo | | $210.00 | $350.00 | | $0 | $840 | $1,400 | $0 | $2,240 |
| 3.2 Construction Survey Support | 7 | day | $1,025.00 | | | | $7,175 | $0 | $0 | $0 | $7,175 |
| 3.3 Site Superintendent | 16 | week | | | $1,234.20 | | $0 | $0 | $19,747 | $0 | $19,747 |
| 3.4 Site Health & Safety and QA/QC | 16 | week | | | $701.20 | | $0 | $0 | $11,219 | $0 | $11,219 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 3 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $3,426 | $6,306 | $4,359 | $14,091 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 3,000 | gal | | $0.20 | | | $0 | $600 | $0 | $0 | $600 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 3 | mo | | | | $730.00 | $0 | $0 | $0 | $2,190 | $2,190 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 3 | mo | | | | $656.00 | $0 | $0 | $0 | $1,968 | $1,968 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 3 | mo | $950.00 | | | | $2,850 | $0 | $0 | $0 | $2,850 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dozer, 105 hp | 15 | day | | | $318.80 | $532.40 | $0 | $0 | $4,782 | $7,986 | $12,768 |
| 5.2 Brush Chipper | 15 | day | | | | $298.20 | $0 | $0 | $0 | $4,473 | $4,473 |
| 5.3 Site Labor, (3 laborers) | 15 | day | | | $726.00 | | $0 | $0 | $10,890 | $0 | $10,890 |
| 5.4 Dewater Pad, 100' by 100' | 10,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $14,500 | $1,600 | $2,000 | $18,100 |
| **6 EXCAVATION AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Excavator, long arm | 25 | day | | | $327.60 | $1,200.00 | $0 | $0 | $8,190 | $30,000 | $38,190 |
| 6.2 Dozer, 105 hp | 25 | day | | | $318.80 | $532.40 | $0 | $0 | $7,970 | $13,310 | $21,280 |
| 6.3 Off-road Truck, 25 cy, 2 each | 50 | day | | | $244.80 | $1,060.00 | $0 | $0 | $12,240 | $53,000 | $65,240 |
| 6.4 Swamp Mats, 11,000 sf | 5 | week | | | | $2,630.00 | $0 | $0 | $0 | $13,150 | $13,150 |
| 6.5 Wheeled Front-end Loader | 25 | day | | | $318.80 | $826.80 | 0 | $0 | $7,970 | $20,670 | $28,640 |
| 6.6 Dewatering Pumps, 2 each | 25 | day | | | | $345.80 | $0 | $0 | $0 | $8,645 | $8,645 |
| 6.7 Site Labor, (3 laborers) | 25 | day | | | $726.00 | | $0 | $0 | $18,150 | $0 | $18,150 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 9,938 | ton | $75.00 | | | | $745,350 | $0 | $0 | $0 | $745,350 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 6 | ea | $1,000.00 | $20.00 | | | $6,000 | $120 | $0 | $0 | $6,120 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, long arm | 40 | day | | | $327.60 | $1,200.00 | $0 | $0 | $13,104 | $48,000 | $61,104 |
| 7.2 Dozer, 105 hp | 40 | day | | | $318.80 | $532.40 | $0 | $0 | $12,752 | $21,296 | $34,048 |
| 7.3 Swamp Mats, 11,000 sf | 8 | week | | | | $2,630.00 | $0 | $0 | $0 | $21,040 | $21,040 |
| 7.4 Site Labor, (3 laborers) | 40 | day | | | $726.00 | | $0 | $0 | $29,040 | $0 | $29,040 |
| 7.5 Select Fill | 7,361 | cy | | $12.00 | | | $0 | $88,332 | $0 | $0 | $88,332 |
| 7.6 Roadway Replacement, 400' by 15' | 670 | sy | | $20.57 | | $0.92 | $0 | $13,782 | $0 | $616 | $14,398 |
| 7.7 Wetlands Restoration | 1.5 | ac | $30,000.00 | | | | $45,000 | $0 | $0 | $0 | $45,000 |
| 7.8 Grade & Seed Cover | 22,083 | sy | | $0.42 | $1.53 | $0.29 | $0 | $9,275 | $33,787 | $6,404 | $49,466 |
| **Subtotal** | | | | | | | $806,375 | $135,375 | $216,501 | $266,344 | $1,424,596 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $64,950 | | $64,950 |
| G & A on Labor Cost @ 10% | | | | | | | | | $21,650 | | $21,650 |
| G & A on Material Cost @ 10% | | | | | | | | $13,537 | | | $13,537 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $26,634 | $26,634 |
| G & A on Subcontract Cost @ 10% | | | | | | | $80,638 | | | | $80,638 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $8,122 | | $15,981 | $24,103 |
| **Total Direct Cost** | | | | | | | $887,013 | $157,035 | $303,102 | $308,960 | $1,656,109 |

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Cost @ 30% | (excluding transportation and disposal cost) | | | | | | | | | | $272,373 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $165,611 |
| **Subtotal** | | | | | | | | | | | $2,094,092 |
| Health & Safety Monitoring @ 2% | | | | | | | | | | | $41,882 |
| Delineation Sampling | | | | | | | | | | | $74,088 |
| **Total Field Cost** | | | | | | | | | | | $2,210,062 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $442,012 |
| Engineering on Total Field Cost @ 5% | | | | | | | | | | | $110,503 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$2,762,578** |

**Wetland 64**

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 2**
**Capital Cost**

7/31/2009 12:33 PM

| | Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 | Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 | Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| 2 | **SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 | Warning Signs | 44 | ea | | $66.50 | $120.00 | | $0 | $2,926 | $5,280 | $0 | $8,206 |
| | **Subtotal** | | | | | | | $0 | $2,926 | $15,780 | $0 | $18,706 |
| | Overhead on Labor Cost @ 30% | | | | | | | | | $4,734 | | $4,734 |
| | G & A on Labor Cost @ 10% | | | | | | | | | $1,578 | | $1,578 |
| | G & A on Material Cost @ 10% | | | | | | | | $293 | | | $293 |
| | G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| | G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| | Tax on Materials and Equipment Cost @ 6% | | | | | | | | $176 | | $0 | $176 |
| | **Total Direct Cost** | | | | | | | $0 | $3,394 | $22,092 | $0 | $25,486 |
| | Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| | Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,549 |
| | **Subtotal** | | | | | | | | | | | $28,035 |
| | Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| | **Total Field Cost** | | | | | | | | | | | $28,035 |
| | Contingency on Total Field Costs @ 25% | | | | | | | | | | | $7,009 |
| | Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| | **TOTAL CAPITAL COST** | | | | | | | | | | | **$35,043** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 2**
**Annual Cost**

7/31/2009 12:33 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $2,956 | $4,000 | |
| Contingency @ 10% | $296 | $400 | |
| **TOTAL** | **$3,252** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 2**
**Present Worth Analysis**

7/31/2009 12:33 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $35,043 | | $35,043 | 1.000 | $35,043 |
| 1 | | $3,252 | $3,252 | 0.935 | $3,040 |
| 2 | | $3,252 | $3,252 | 0.873 | $2,839 |
| 3 | | $3,252 | $3,252 | 0.816 | $2,653 |
| 4 | | $3,252 | $3,252 | 0.763 | $2,481 |
| 5 | | $7,652 | $7,652 | 0.713 | $5,456 |
| 6 | | $3,252 | $3,252 | 0.666 | $2,166 |
| 7 | | $3,252 | $3,252 | 0.623 | $2,026 |
| 8 | | $3,252 | $3,252 | 0.582 | $1,892 |
| 9 | | $3,252 | $3,252 | 0.544 | $1,769 |
| 10 | | $7,652 | $7,652 | 0.508 | $3,887 |
| 11 | | $3,252 | $3,252 | 0.475 | $1,545 |
| 12 | | $3,252 | $3,252 | 0.444 | $1,444 |
| 13 | | $3,252 | $3,252 | 0.415 | $1,349 |
| 14 | | $3,252 | $3,252 | 0.388 | $1,262 |
| 15 | | $7,652 | $7,652 | 0.362 | $2,770 |
| 16 | | $3,252 | $3,252 | 0.339 | $1,102 |
| 17 | | $3,252 | $3,252 | 0.317 | $1,031 |
| 18 | | $3,252 | $3,252 | 0.296 | $962 |
| 19 | | $3,252 | $3,252 | 0.277 | $901 |
| 20 | | $7,652 | $7,652 | 0.258 | $1,974 |
| 21 | | $3,252 | $3,252 | 0.242 | $787 |
| 22 | | $3,252 | $3,252 | 0.226 | $735 |
| 23 | | $3,252 | $3,252 | 0.211 | $686 |
| 24 | | $3,252 | $3,252 | 0.197 | $641 |
| 25 | | $7,652 | $7,652 | 0.184 | $1,408 |
| 26 | | $3,252 | $3,252 | 0.172 | $559 |
| 27 | | $3,252 | $3,252 | 0.161 | $524 |
| 28 | | $3,252 | $3,252 | 0.150 | $488 |
| 29 | | $3,252 | $3,252 | 0.141 | $458 |
| 30 | | $7,652 | $7,652 | 0.131 | $1,002 |
| | | | | **TOTAL PRESENT WORTH** | **$84,879** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 3**
**Capital Cost**

7/31/2009 12:33 PM

| Item | Quantity | Unit | Unit Cost | | | | Extended Cost | | | | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Subcontract* | *Material* | Labor | Equipment | Subcontract | Material | Labor | Equipment | |
| **1 PROJECT PLANNING & DOCUMENTS** | | | | | | | | | | | |
| 1.1 Prepare LUC Documents | 200 | hr | | | $35.00 | | $0 | $0 | $7,000 | $0 | $7,000 |
| 1.2 Prepare Documents & Plans including Permits | 100 | hr | | | $35.00 | | $0 | $0 | $3,500 | $0 | $3,500 |
| **2 SIGN PLACEMENT** | | | | | | | | | | | |
| 2.1 Warning Signs | 44 | ea | | $66.50 | $120.00 | | $0 | $2,926 | $5,280 | $0 | $8,206 |
| **Subtotal** | | | | | | | $0 | $2,926 | $15,780 | $0 | $18,706 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $4,734 | | $4,734 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,578 | | $1,578 |
| G & A on Material Cost @ 10% | | | | | | | | $293 | | | $293 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $0 | $0 |
| G & A on Subcontract Cost @ 10% | | | | | | | $0 | | | | $0 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $176 | | $0 | $176 |
| **Total Direct Cost** | | | | | | | $0 | $3,394 | $22,092 | $0 | $25,486 |
| Indirects on Total Direct Cost @ 0% | | | | | | | | | | | $0 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,549 |
| **Subtotal** | | | | | | | | | | | $28,035 |
| Health & Safety Monitoring @ 0% | | | | | | | | | | | $0 |
| **Total Field Cost** | | | | | | | | | | | $28,035 |
| Contingency on Total Field Costs @ 25% | | | | | | | | | | | $7,009 |
| Engineering on Total Field Cost @ 0% | | | | | | | | | | | $0 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$35,043** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 3**
**Annual Cost**

7/31/2009 12:33 PM

| Item | Item Cost years 1 - 30 | Item Cost every 5 years | Notes |
|---|---|---|---|
| Site Inspection: Visit | $2,156 | | One-day visit to verify LUC |
| Site Inspection: Report | $800 | | |
| Sampling | $12,900 | | Labor and supplies to collect samples using boat and a crew of two. |
| Analysis/Sediment | $14,784 | | Analyze sediment samples from 16 locations for metals, PCBs, VOCs, SVOCs, and pesticides. Collect samples once in years 1 through 30. |
| Five Year Site Review | | $4,000 | Labor and supplies to evaluate site every five years for 5-year review |
| SUBTOTAL | $30,640 | $4,000 | |
| Contingency @ 10% | $3,064 | $400 | |
| **TOTAL** | **$33,704** | **$4,400** | |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 3**
**Present Worth Analysis**

7/31/2009 12:33 PM

| Year | Capital Cost | Annual Cost | Total Year Cost | Annual Discount Rate at 7% | Present Worth |
|---|---|---|---|---|---|
| 0 | $35,043 | | $35,043 | 1.000 | $35,043 |
| 1 | | $33,704 | $33,704 | 0.935 | $31,513 |
| 2 | | $33,704 | $33,704 | 0.873 | $29,424 |
| 3 | | $33,704 | $33,704 | 0.816 | $27,502 |
| 4 | | $33,704 | $33,704 | 0.763 | $25,716 |
| 5 | | $38,104 | $38,104 | 0.713 | $27,168 |
| 6 | | $33,704 | $33,704 | 0.666 | $22,447 |
| 7 | | $33,704 | $33,704 | 0.623 | $20,998 |
| 8 | | $33,704 | $33,704 | 0.582 | $19,616 |
| 9 | | $33,704 | $33,704 | 0.544 | $18,335 |
| 10 | | $38,104 | $38,104 | 0.508 | $19,357 |
| 11 | | $33,704 | $33,704 | 0.475 | $16,009 |
| 12 | | $33,704 | $33,704 | 0.444 | $14,965 |
| 13 | | $33,704 | $33,704 | 0.415 | $13,987 |
| 14 | | $33,704 | $33,704 | 0.388 | $13,077 |
| 15 | | $38,104 | $38,104 | 0.362 | $13,794 |
| 16 | | $33,704 | $33,704 | 0.339 | $11,426 |
| 17 | | $33,704 | $33,704 | 0.317 | $10,684 |
| 18 | | $33,704 | $33,704 | 0.296 | $9,976 |
| 19 | | $33,704 | $33,704 | 0.277 | $9,336 |
| 20 | | $38,104 | $38,104 | 0.258 | $9,831 |
| 21 | | $33,704 | $33,704 | 0.242 | $8,156 |
| 22 | | $33,704 | $33,704 | 0.226 | $7,617 |
| 23 | | $33,704 | $33,704 | 0.211 | $7,112 |
| 24 | | $33,704 | $33,704 | 0.197 | $6,640 |
| 25 | | $38,104 | $38,104 | 0.184 | $7,011 |
| 26 | | $33,704 | $33,704 | 0.172 | $5,797 |
| 27 | | $33,704 | $33,704 | 0.161 | $5,426 |
| 28 | | $33,704 | $33,704 | 0.150 | $5,056 |
| 29 | | $33,704 | $33,704 | 0.141 | $4,752 |
| 30 | | $38,104 | $38,104 | 0.131 | $4,992 |
| | | | | **TOTAL PRESENT WORTH** | **$462,763** |

**NAS PENSACOLA**
**Pensacola, Florida**
**Wetland 64**
**Alternative Sediment 4**
**Capital Cost**

7/31/2009 12:33 PM

| Item | Quantity | Unit | Unit Cost | | | | Extended Cost | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Subcontract | Material | Labor | Equipment | Subcontract | Material | Labor | Equipment | Subtotal |
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Construction/Work Plans | 250 | hr | | | $37.00 | | $0 | $0 | $9,250 | $0 | $9,250 |
| 1.2 Contractor Completion Report | 150 | hr | | | $37.00 | | $0 | $0 | $5,550 | $0 | $5,550 |
| **2 MOBILIZATION AND DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Preconstruction Meeting | 30 | hr | | | $65.00 | | $0 | $0 | $1,950 | $0 | $1,950 |
| 2.2 Site Support Facilities (trailers, phone, electric, etc.) | 1 | ls | | $1,000.00 | | $3,500.00 | $0 | $1,000 | $0 | $3,500 | $4,500 |
| 2.3 Equipment Mobilization/Demobilization | 4 | ea | | | $163.00 | $414.00 | $0 | $0 | $652 | $1,656 | $2,308 |
| **3 FIELD SUPPORT** | | | | | | | | | | | |
| 3.1 Site Support Facilities (trailers, phone, electric, etc.) | 5 | mo | | $210.00 | $350.00 | | $0 | $1,050 | $1,750 | $0 | $2,800 |
| 3.2 Construction Survey Support | 15 | day | $1,025.00 | | | | $15,375 | $0 | $0 | $0 | $15,375 |
| 3.3 Site Superintendent | 22 | week | | | $1,234.20 | | $0 | $0 | $27,152 | $0 | $27,152 |
| 3.4 Site Health & Safety and QA/QC | 22 | week | | | $701.20 | | $0 | $0 | $15,426 | $0 | $15,426 |
| **4 DECONTAMINATION** | | | | | | | | | | | |
| 4.1 Decontamination Services | 3 | mo | | $1,142.00 | $2,102.00 | $1,453.00 | $0 | $3,426 | $6,306 | $4,359 | $14,091 |
| 4.2 Equipment Decon Pad | 1 | ls | | $3,500.00 | $3,000.00 | $425.00 | $0 | $3,500 | $3,000 | $425 | $6,925 |
| 4.3 Decon Water | 3,000 | gal | | $0.20 | | | $0 | $600 | $0 | $0 | $600 |
| 4.4 Decon Water Storage Tank, 6,000 gallon | 3 | mo | | | | $730.00 | $0 | $0 | $0 | $2,190 | $2,190 |
| 4.5 Clean Water Storage Tank, 4,000 gallon | 3 | mo | | | | $656.00 | $0 | $0 | $0 | $1,968 | $1,968 |
| 4.6 Disposal of Decon Waste (liquid & solid) | 3 | mo | $950.00 | | | | $2,850 | $0 | $0 | $0 | $2,850 |
| **5 SITE PREPARATION** | | | | | | | | | | | |
| 5.1 Dock Removal/Replacement | 1 | ls | $10,000.00 | | | | $10,000 | $0 | $0 | $0 | $10,000 |
| 5.2 Site Labor, (3 laborers) | 10 | day | | | $726.00 | | $0 | $0 | $7,260 | $0 | $7,260 |
| 5.3 Dewater Pad, 100' by 100' | 20,000 | sf | | $1.45 | $0.16 | $0.20 | $0 | $29,000 | $3,200 | $4,000 | $36,200 |
| **6 DREDGING AND DISPOSAL** | | | | | | | | | | | |
| 6.1 Hydraulic Dredging into geotubes | 30,000 | cy | $35.00 | | | | $1,050,000 | $0 | $0 | $0 | $1,050,000 |
| 6.2 Containment Piping, 18" dia. | 900 | lf | | $14.35 | $6.84 | $0.59 | $0 | $12,915 | $6,156 | $531 | $19,602 |
| 6.3 Turbidity Curtain | 2,100 | lf | | $10.60 | $6.57 | | $0 | $22,260 | $13,797 | $0 | $36,057 |
| 6.4 Excavator, 2 cy | 60 | day | | | $327.60 | $1,060.00 | $0 | $0 | $19,656 | $63,600 | $83,256 |
| 6.5 Wheeled Front-end Loader | 60 | day | | | $318.80 | $826.80 | 0 | $0 | $19,128 | $49,608 | $68,736 |
| 6.6 Dewatering Pumps, 2 each | 60 | day | | | | $345.80 | $0 | $0 | $0 | $20,748 | $20,748 |
| 6.7 Site Labor, (3 laborers) | 60 | day | | | $726.00 | | $0 | $0 | $43,560 | $0 | $43,560 |
| 6.8 Off Site Disposal, Non-Hazardous Soil | 46,000 | ton | $75.00 | | | | $3,450,000 | $0 | $0 | $0 | $3,450,000 |
| 6.9 Characterization/Offsite Disposal Soil Testing | 41 | ea | $1,000.00 | $20.00 | | | $41,000 | $820 | $0 | $0 | $41,820 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Excavator, 2 cy | 50 | day | | | $327.60 | $1,060.00 | $0 | $0 | $16,380 | $53,000 | $69,380 |
| 7.2 Hydraulic Dredging | 3.5 | ac | $79,000.00 | | | | $276,500 | $0 | $0 | $0 | $276,500 |
| 7.3 Site Labor, (3 laborers) | 50 | day | | | $726.00 | | $0 | $0 | $36,300 | $0 | $36,300 |
| 7.4 Select Fill | 37,074 | cy | | $12.00 | | | $0 | $444,888 | $0 | $0 | $444,888 |
| 7.5 Wetlands Restoration | 3.5 | ac | $30,000.00 | | | | $105,000 | $0 | $0 | $0 | $105,000 |
| **Subtotal** | | | | | | | $4,950,725 | $519,459 | $236,474 | $205,585 | $5,912,243 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $70,942 | | $70,942 |
| G & A on Labor Cost @ 10% | | | | | | | | | $23,647 | | $23,647 |
| G & A on Material Cost @ 10% | | | | | | | | $51,946 | | | $51,946 |
| G & A on Equipment Cost @ 10% | | | | | | | | | | $20,559 | $20,559 |
| G & A on Subcontract Cost @ 10% | | | | | | | $495,073 | | | | $495,073 |
| Tax on Materials and Equipment Cost @ 6% | | | | | | | | $31,168 | | $12,335 | $43,503 |
| **Total Direct Cost** | | | | | | | $5,445,798 | $602,572 | $331,063 | $238,479 | $6,617,912 |
| Indirects on Total Direct Cost @ 30% | | | (excluding transportation and disposal cost) | | | | | | | | $949,519 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $661,791 |

| Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subtotal** | | | | | | | | | | | $8,229,222 |
| Health & Safety Monitoring @ 1% | | | | | | | | | | | $82,292 |
| Delineation Sampling | | | | | | | | | | | $124,364 |
| **Total Field Cost** | | | | | | | | | | | $8,435,878 |
| Contingency on Total Field Costs @ 20% | | | | | | | | | | | $1,687,176 |
| Engineering on Total Field Cost @ 1% | | | | | | | | | | | $84,359 |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$10,207,412** |